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A
MANUAL OF EXAMINATIONS.

BY

J. L. LUDLOW, M.D.

A
MANUAL OF EXAMINATIONS

UPON

ANATOMY, PHYSIOLOGY, SURGERY, PRACTICE OF MEDICINE, CHEMISTRY, OBSTETRICS, MATERIA MEDICA, PHARMACY AND THERAPEUTICS.

ESPECIALLY DESIGNED FOR STUDENTS OF MEDICINE.

TO WHICH IS ADDED,

A MEDICAL FORMULARY.

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PREFACE

TO

THE NEW EDITION.

In the preface to the first edition of this work the author stated that he claimed for it simply what its title indicates, "A Manual of Examinations"—the object being "to give at a glance the principal points necessary to guide the student in the prosecution of his studies, and to revive his recollection of subjects treated upon in more voluminous works." The science of medicine and its collateral branches having made rapid strides since the issue of the second edition, the author has been under the necessity of remodelling many parts of the work, and making numerous additions with a view to its general improvement, while at the same time he has not been unmindful of the advantages of illustrations, which are freely distributed throughout the volume. These additions and modifications have been accommodated by the increase of the number and enlarge-

ment of the pages, and by a general revision and condensation of the questions. While making these improvements, the author has kept in view the scope of the work, which as a guide to the student, and a remembrancer or index to the more valuable and recondite works in the different departments of our science, is again presented for the favourable consideration of the profession.

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SIGNS AND ABBREVIATIONS

USED IN THIS AND MEDICAL WORKS GENERALLY.

ENGLISH.	LATIN.	SYMBOL.	CONTAINS.
A pound,	Libra,	℔,	12 ounces.
An ounce,	Uncia,	℥,	8 drachms.
A drachm,	Drachm,	ʒ,	3 scruples.
A scruple,	Scrupulus,	℈,	20 grains.
A gallon,	Congius,	None,	8 pints,
A pint,	Octarius,	O,	16 fluidounces.
A fluidounce,	Fluiduncia,	f℥,	8 fluidrachms.
A fluidrachm,	Fluidrachma,	fʒ,	60 minims.

Ten minims of any fluid, if measured by the graduated minim measure, are equal to about .... 15 drops.

A teacup is estimated to contain about 4 fluidounces, or a gill.

A wineglass .... 2 fluidounces.

A tablespoon (cochlear magnum) .... half a fluidounce.

A teaspoon (cochlear parvum) .... a fluidrachm.

A drop is generally estimated to contain the sixtieth part of a fluidrachm, but it varies with different fluids, and the mouth of the bottle from which it is dropped, &c.; hence a *minim measure* is preferable in accurately administering liquids in small quantities.

ABBREVIATION.	LATIN.	ENGLISH WORD.
āā,	Ana,	Of each.
Ad. saturand.	Ad. saturandum,	Until saturated.
Ad. lib.	Ad. libitum,	At will.
Aq. tepid	Aqua tepida,	Warm water.
Aq. fervid,	Aqua fervens,	Hot water.
Aq. bullient.	Aqua bulliens,	Boiling water.
Charts, or chts.	Chartula,	A paper.
Coch.	Cochlear,	A spoonful.
Coch. mag.	Cochlear magnum,	A tablespoonful.
Coch. parv.	Cochlear parvum	A teaspoonful.
Colent.	Colentur,	Let them be strained.
Collyr.	Collyrium,	An eye-water.
Contus.	Contusus,	Bruised.
Cort.	Cortex,	A bark.
Decoct.	Decoctum,	A decoction.
Ext.	Extractum,	An extract.
F. vel. Ft.	Fiat vel Fiant,	Let them be made.
Fol.	Folium,	A leaf.
Garg.	Gargarysma,	A gargle.
Gr.—grs.	Granum vel grana,	A grain or grains.
Gtt.—gtts.	Gutta vel guttæ,	Drop or drops.
Haust.	Haustus,	A draught.
Infus.	Infusum,	An infusion.
♍	Minimum vel minima,	A minim or minims.
M.	Misce,	Mix.
Mass.	Massa,	A mass.
Mist.	Mistura,	A mixture.
Pil.	Pilula vel Pilulæ,	Pill or pills.
Pulv. vel Pv.	Pulvis vel pulveres,	Powder or powders.
q. s.	Quantum sufficit,	A sufficient quantity.
℞.	Recipe,	Take.
Rad.	Radix,	A root.
Ras.	Rasus,	Rasped.
S.	Signa,	Write.
Sem.	Semen,	A seed.
Ss.	Semis,	A half.
Spts.	Spiritus,	Spirits.
Syr.	Syrupus,	A syrup.
Tinc. vel Tr.	Tinctura,	A tincture.

MANUAL

OF

EXAMINATIONS.

PART I.

ANATOMY.

What is Human Anatomy?—That science which teaches the structure of the human body.

ANATOMY OF THE SKELETON.

What is a human skeleton?—The bony frame-work of the human body, retaining the whole frame in shape, and affording attachment for the muscles and protecting many of the viscera.

What is a natural and an artificial skeleton?—A natural skeleton is one which is held together by its natural attachments of ligaments, cartilages, and synovial membranes; and an artificial one is one held together by wires and plates of metal.

What are the regional divisions of the skeleton?—The head, trunk, superior and inferior extremities.

BONES GENERALLY.

Is not the number of the bones greater in infancy than in more advanced life?—Yes; for many of the bones which are separable in infancy become coalesced in advanced life.

What are the names of the bones of the head?—Occipital, frontal, sphenoidal, ethmoidal, two temporal containing the bones of the tympanum, two superior maxillary, two palate, two malar, two nasal, two unguiform or lachrymal, two inferior turbinated, a vomer and an inferior maxillary.

What are the names of the bones of the trunk?—Twenty-four true vertebræ, one sacrum, four bones of the coccyx, two innominata, twelve ribs on each side, a sternum, and the hyoid bone in the throat.

What are the names of the bones of the upper extremities?—The clavicle, scapula, humerus, radius, ulna, eight bones of the carpus, five of the metacarpus, two phalanges of the thumb, three phalanges to each finger, and two and sometimes more sesamoid bones.

What are the names of the bones of the lower extremities?—The os femoris, the tibia, the fibula, seven bones of the tarsus, five of the metatarsus, two phalanges of the big toe, three phalanges to each of the smaller toes, and two and sometimes more sesamoid bones.

How many bones are there in all?—Two hundred and eleven, sometimes increased by the addition of sesamoids.

What are the general classes of bones?—They are divided into three classes; viz., the long or cylindrical, the broad or flat, and the thick.

What are the epiphyses of bones?—A portion of bone separated from the body of a bone by a cartilage which becomes united to the bone by the ossification of this cartilage.

What is the general structure of epiphyses?—Spongy.

What are the diaphyses of bones?—The middle portions of the long bones placed between the epiphyses.

What is the general structure of the diaphyses?—Internally they are reticulated, exteriorly they are compact.

What are the apophyses of bones?—Projections, or distinct portions of bones.

How do apophyses differ from epiphyses?—In being less easily separable from the bone to which they belong—no layer of cartilages being interposed between them.

What is the intimate structure of all bones?—They consist of a cellular, reticular, and vascular parenchyma; and of osseous matter deposited in it: their base, therefore, being the same with that of the muscles, nerves, and soft parts of the body.

Are bones vascular?—Yes; but more especially during the ossific process.

Where do their vessels enter?—By numerous small foramina all over their external surface.

What is the best demonstration of the vascularity of bones?—From the tinge which they receive in animals with whose food madder has been mixed, and by fine colored injections.

What is the chemical composition of bones?—32 parts of gelatine soluble in water; 1 part of insoluble animal matter; 51 parts of phosphate or subphosphate of lime; 11 carbonate of lime; 2 fluate of lime; 1 phosphate of magnesia; 1 soda and muriate of soda, with some iron, manganese, silex, alumina, and phosphate of ammonia.

What is the periosteum?—The membrane which surrounds bones excepting where covered by articular cartilages.

What is its organization? — Fibrous.

Has it blood-vessels, nerves, and lymphatics? — Blood-vessels are abundant, the lymphatics are few, and there is a strong probability of the existence of nerves.

What are the uses of the periosteum? — To strengthen the union of bones with their epiphyses, to afford attachments to ligaments and muscles, and to permit the muscles to glide smoothly over the bones, and to conduct and support vessels in their passage to the bones.

What is the medulla of bones? — An oleaginous fluid deposited in their internal cells.

How is it secreted? — By minute arteries which ramify upon the cells of the internal periosteum.

What is the periosteum internus? — The delicate membrane which lines the internal cavities of bones.

What other use has it besides secreting the marrow? — It nourishes the bones.

Where do the medullary arteries of bones penetrate them? — Generally about the middle by oblique canals.

What are foramina? — Holes perforating the substance of bones, without leaving any long track within their substance.

What are canals? — Foramina contained within the substance of bones.

What are sinuses? — Great cavities in bones with small openings.

What are sinuosities? — Superficial, but broad, irregular depressions.

What are furrows? — Long, narrow, and superficial canals.

What are notches? — Cavities in the margins of bones.

What are fossæ? — Deep and large cavities upon their surface.

What are pits? — Small though deep depressions.

What are glenoid cavities? — Smooth, shallow, cavities for articulation.

What are cotyloid cavities? — Deep and smooth ones for articulation.

What are tubercles? — Small eminences.

What are tuberosities? — Greater and rough elevations.

What are spines? — Long projections upon the bone.

What are heads? — The round tops of bones.

What are necks? — The narrow portions of bones beneath their heads.

What are processes? — Short projecting portions of bones.

What is the name of that division of anatomy which treats of the growth of bones? — Osteogony.

What are the three different stages of ossification? — 1st. The Mucous; 2. Cartilaginous; 3. Ossific.

How are bones formed? — By the deposition of ossific matter, either in membranes or cartilages.

What are the constituent parts of bones? — A cellular and vascular parenchyma, and phosphate of lime with other saline combinations.

What are the phenomena of ossification? — The arteries of the

part about to undergo this process become dilated; though formerly transparent they now assume a red color; and according to Valentin, Schwann, and Muller, the bone is formed by an immediate transformation of the cartilage corpuscles into bone corpuscles.

How does ossification take place in the diaphyses of long bones?—It begins in the middle, forming flat rings between the external and internal periosteum.

How does ossification take place in the epiphyses of long bones?—In distinct points, which gradually unite.

How does ossification take place in the bones of the cranium?—It assumes the appearance of radii diverging from a centre in several points.

What bones are perfectly formed at birth?—The small bones of the ear.

What parts of bones are latest ossified?—The epiphyses.

When does ossification in the epiphyses terminate?—From the seventh to the fourteenth year.

When are the epiphyses generally completely united to the diaphyses?—About the twenty-first year.

How does ossification take place in thick bones?—From one or more points according to the complexity of their figure.

Does not the period of ossification differ in different bones?—Yes; the lateral bones of the vertebræ appear early, those of the head commence in the inferior maxilla, then the os frontis, and afterwards in the other bones of the face, the central part of the ribs, and nearly simultaneously the shafts of the long bones, the smaller bones of the extremities follow, and then the carpus and tarsus.

How are bones lengthened?—By the deposition of ossific matter upon both ends.

How are they thickened?—By the continual secretion from the internal surface of the periosteum, and they are afterwards modified by interstitial deposition and absorption.

What are the phenomena attending the formation of callus in cases of fracture of bones?—First, from the rupture of the soft parts, we have effusion of blood and inflammation into the cavity of the fracture, in the mean time the blood is being absorbed, and an effusion of coagulating lymph is taking place in the cavity of the fracture, a ring is formed by the lacerated parts ossifying, and at the same time an osseous pin is forming in the interior of the bone. Till this moment no change has taken place in the bone excepting a coating of coagulating lymph being deposited upon the broken edges; now the edges begin to unite themselves, the ring and the pin (the provisional callus) is absorbed, and the cavity of the bone and its membranes are re-established

BONES INDIVIDUALLY.

TRUNK.

Into what parts are the bones of the trunk divided?—Into the spine, thorax, and pelvis.

SPINE.

What is the situation of the spine?—At the posterior part of the trunk.

What is its general form?—That of two inverted pyramids.

What is the general division of the spine?—Into the true and false vertebræ.

What is the number of the true vertebræ?—Twenty-four.

Into what classes are the true vertebræ divided?—Into those of the neck or cervical, those of the back or dorsal, and those of the loins or lumbar vertebræ.

Which are the false vertebræ?—The sacrum and coccyx, consisting of three or four pieces.

Of what parts do the vertebræ in general consist?—Each has a body, a bony ring, and seven processes.

What is the situation and form of the bodies of the vertebræ?—They are placed anteriorly, and represent a portion of a cylinder cut transversely, which is somewhat round anteriorly, and sloped posteriorly.

What are the names of the vertebral processes?—Four of them are oblique or articular, consisting of two superior and two inferior; three serve the purpose of muscular attachment, of which two, from their situation, are called transverse, and one spinous.

Where is the ring of the vertebræ situated?—Immediately behind the body, and within the processes.

What do the rings of the vertebræ when connected form?—The vertebral canal.

What occupies the vertebral canal?—The spinal marrow, its vessels and involucra.

Where are the oblique or articular processes of the vertebræ situated?—Above and below the posterior part of the body.

Where are the transverse processes situated?—At the sides of the ring.

Where are the spinous processes situated?—At the back of the ring.

Where are the notches of the vertebræ situated?—On each side, between the body and ring, there are four notches, two being situated superiorly, and two inferiorly.

What is the use of these notches?—When two vertebræ are joined together, these notches form holes which serve to transmit the spinal nerves.

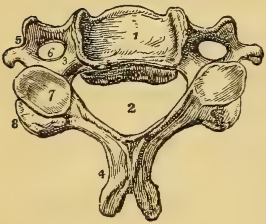
What is the internal structure of the vertebræ? — They are of a spongy texture.

How are the vertebræ connected? — They are connected to each other by their bodies, and by their articular processes, ligaments, intervertebral substance, &c.

CERVICAL VERTEBRÆ.

What are the peculiarities of the cervical vertebræ? — The bodies (Fig. 1.) are small, flattened anteriorly, and thinner than the other vertebræ,[1] their upper sides are concave from side to side, and their lower hollowed from before backward. [2] The spinal foramen is large and triangular. [3] The superior and inferior intervertebral notches are nearly equal in depth. [4] Their spinous processes are straighter and forked at the extremity. [5] The transverse processes are shorter, slightly bifurcated, and perforated perpendicularly at their bases,[6] and are grooved on their upper side.[7] The oblique processes are more oblique than those of the other vertebræ, the superior presenting upwards and backwards, the inferior downwards and forwards.[8]

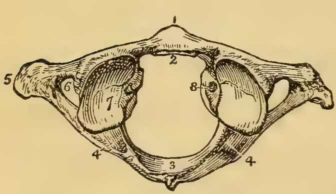
Fig. 1.



What is the name of the first vertebra? — It is called the atlas. (Fig. 2.)

Describe the atlas. — It is a simple ring larger than the other vertebræ, having anterior and posterior arches within a tubercle projecting from the anterior arch.[1] An articular surface for the odontoid process of the second vertebræ upon the posterior part of the anterior arch.[2] A small tubercle instead of a spinous process on the posterior arch.[3] The intervertebral notches are behind instead of before the articular processes.[4] The transverse processes are large and long, and are perforated with a foramen for the vertebral artery.[6] The superior articular processes are large, and form oblong horizontal cavities of which the anterior extremities are nearest.[7] The inferior are round, broad, and sloped inwards. Small tuberosities exist on the inner sides of the anterior arch for the attachment of the transverse ligament to govern the odontoid process of the second vertebra.[8] The spinal foramen is large.

Fig. 2.



What is the name of the second cervical vertebra? — Vertebra dentata.

How does the body of the dentata differ from those of the rest?—Its body is narrower and longer, and has upon its upper part a pivot or axis called odontoides or dens.

What are the marks upon this process?—Two for the transverse ligaments upon its posterior part; one on its apex for the middle straight ligament; one on each side for the moderator ligaments.

How does the spinous process of the dentata differ from those of the rest?—It is short, broad, and much forked, its lower side is hollowed by an angular cavity, and divided into two lateral parts by a bony line.

How do the transverse processes of this bone differ from the rest?—They are very short, slightly turned downward, and perforated obliquely.

How do the superior articular processes of this vertebra differ from those of the rest?—They are very large, a little convex, placed nearly horizontal on each side of the tooth-like process.

Is their sufficient difference in the cervical vertebræ from the second to the seventh to require any particular description?—No.

What are the peculiarities of the seventh or last cervical vertebra?—Its body is larger and less concave than the others, and its inferior face is flat, the spinous process is the longest of all, is not bifurcated, and terminates in a tubercle, its transverse processes are thrown back, the small foramen in them does not transmit the vertebral vessels, and sometimes on the side of its body we have a small facet by which it partially articulates with the first rib.

DORSAL VERTEBRÆ.

What is peculiar to the bodies of the dorsal vertebræ in general?—They are most convex anteriorly, their upper and lower surfaces are nearly flat, and on each side there are two little articular surfaces, one above and one below, to receive the heads of the ribs, they diminish in the transverse diameter of their bodies from the first to the third, and afterwards increase regularly in size to the last.

How do the spinous processes differ from the rest?—They are long and sharp superiorly; slightly hollowed inferiorly, and considerably inclined downward.

How do the articular processes differ?—They are placed almost directly above and below the transverse, and are perpendicular rather than oblique; the sides of the superior ones are slightly convex, and turned backward, those of the inferior are the reverse.

How do the transverse processes differ?—They are directed obliquely backwards and downwards; they are pretty long superiorly, but diminish as they descend, those of the twelfth being very small; the anterior part of their tips are cartilaginous, and receive the tubercles of the ribs; these depressions diminish as they descend, and do not exist in the last two.

How do the great foramina of the dorsal vertebræ differ from those of the rest?—The rings become rounder and narrower as they descend from the first to the tenth, where they again begin to be more flat.

How are the first four dorsal vertebræ distinguished from the rest of the same class? — The first four are somewhat flattened anteriorly.

How are the last two dorsal vertebræ distinguished from the rest of the same class?—In the last two the transverse processes have no articular depressions.

LUMBAR VERTEBRÆ.

How are the bodies of the lumbar vertebræ distinguished from those of the dorsal and cervical? — They are much the largest; somewhat contracted about the middle, and their edges are prominent.

How are the spinous processes distinguished from those of the rest? —They are short, straight, and broad on each side, but narrow above and below; that of the last being shorter and narrower than those of the rest.

How are the transverse processes distinguished from the rest? — They are longer and more slender, being flattened anteriorly and posteriorly; they increase in length from the first to the third, they diminish to the fifth, and stand out at right angles.

How are the articular processes distinguished from the rest? —The superior ones are concave lengthwise, the inferior convex lengthwise, and nearer each other than the superior, their convex articulating surfaces being turned outward from each other.

What is the shape of the great foramina of the lumbar vertebræ? — The hole in the rings is flattened anteriorly, and angular posteriorly.

THE PELVIS.

Of what does the pelvis consist? — Of the sacrum, coccyx, and the two innominata.

OS SACRUM.

What is the situation of the os sacrum? — It is placed at the posterior and lower part of the trunk, below the true vertebræ.

What is its form? — It resembles a pyramid with the base upward and apex downward; having an anterior or concave side, a posterior or convex one, and two edges.

Of how many portions does the os sacrum consist in the fœtus? — Of five; the points of separation between which are marked by prominent lines in the adult.[1] (Fig. 3.)

Where is the canal of the os sacrum situated? — Immediately behind its body.

What is its form? — It is triangular.

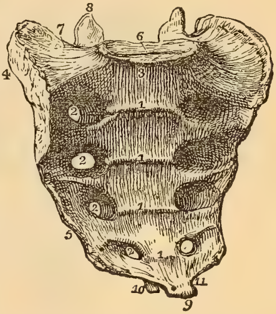
How many foramina open from the canal of the sacrum anteriorly? —four.[2]

How many foramina posteriorly?—The same number.

What do the anterior foramina transmit?—The great sacral nerves.

How many articular processes has this bone?—Two placed at its base, immediately behind its body, and one superiorly, where it unites with the true vertebræ.[6 8]

Fig. 3.



What is the form of the lateral parts of the sacrum?—They are large and broad superiorly; and form an uneven narrow surface as they descend.[4]

What articular surfaces are seen on the lateral parts?—They have on each side a large articulating surface for its union with the ossa innominata.

What are the connexions of the os sacrum?—It is connected laterally to the ossa innominata, superiorly to the last lumbar vertebræ, and inferiorly to the os coccygis.

OS COCCYGIS.

What is the situation of the os coccygis?—It is placed immediately below the sacrum.

What is its form?—It resembles the os sacrum.

Of how many portions does it consist?—It consists of four or five.

Where are the shoulders of the os coccygis situated?—At its upper portion.

OSSA INNOMINATA.

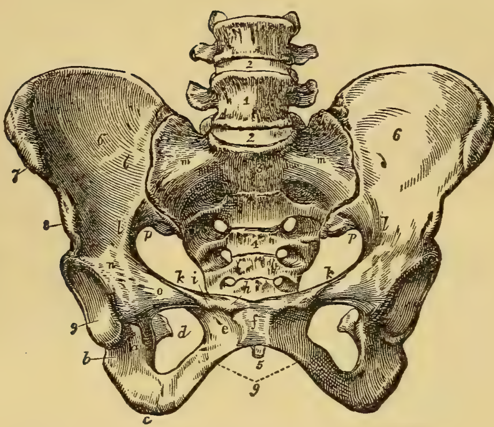
Where are these bones situated?—On either side of the sacrum, and constitute the lateral and anterior parietes of the pelvis, forming with the sacrum and coccyx the whole cavity.

How are they divided by anatomists?—Into the ilia, ischia, and pubes, from the original divisions in the fœtus. (We will consider these separately.)

ILIUM.

Describe the ilium. — It is situated at the superior part of the innominatum and lateral portion of the pelvis (Fig. 4.); externally it is convex, rough, marked by a ridge, above which the gluteus medius arises, and below which is the origin of the gluteus minimus muscle; the posterior part is the roughest, and gives origin to the gluteus maximus. Upon the internal surface[6] anteriorly we have the costa

Fig. 4.



or venter, giving origin to the iliacus internus. Posteriorly it is rough, with a marked articular surface for the sacrum. The *edge* or *crista* is curved, having anteriorly the *anterior superior spinous process,* whence arises Poupart's ligament and sartorius muscle, and the *anterior inferior spinous process,*[8] whence the rectus muscle arises; in the intervening space the gluteus medius arises. The *ilio pectineal*[n] prominence is situated below these processes. Ligaments are attached to *posterior superior* and *inferior spinous processes* which are behind. The *crista* having three edges, gives origin from the internal edge to the transversalis muscle, from the middle to the internal oblique; and into the external edge the external oblique is inserted: we have also the *sciatic notch,*[p] at the inferior part of the ilium.

ISCHIUM.

What is the situation of the os ischium?—At the lower part of the os innominatum.

Into what parts is it divided?—Into a body[b], a tuberosity,[c] and a ramus forming part of the arch.[9]

Where is the spine of the ischium?—Upon the posterior part of its body.

What is attached to its spinous process?—The lesser sacro-ischiatic ligament, and internally the coccygeus muscle.

Where is the acetabulum situated?—On the back of the innominatum, at the junction of the ilum ischium and pubis.

Where is the tuberosity of the ischium?—At the lower and posterior part of its body, where the ramus joins it; and it is that part of the bone upon which we rest in sitting.

What muscles arise from the tuberosity of the ischium? — The quadratus femoris externally; the semimembranosus, semitendinosus, and biceps, about its middle part; the great head of the triceps from its inferior part; and the great sacro-ischiatic ligament is also attached to its inner part.

What is the situation of its ramus? — It ascends forwards from the tuberosity.

What are the notches of the os ischium? — By a very considerable notch anteriorly it contributes to form the obturator foramen; a notch posteriorly between the tuberosity and the spine for the obturator muscle; one laterally between the tuberosity and acetabulum for the obturator externus muscle; and one anteriorly at the edge of the acetabulum for ligaments; vessels and fat are also noticed here.

PUBES.

What is the situation of the os pubis? — At the anterior part of the pelvis.[6]

Into what parts is the os pubis divided? — It is divided into a body,[f] an angle,[h] and ramus.

What is the situation of the body of the os pubis? — At its upper anterior part.[f]

How much does the os pubis contribute to form the acetabulum? — One-fifth.

How does the os pubis partially mark the limits of the pelvis? — By a line on the inner side of its body, forming part of the brim of the pelvis.[k]

Where is the spine of the os pubis? — It is situated about an inch from the angle.[i]

What does its spine give attachment to? — To Poupart's ligament, and in part to the rectus and pyramidalis abdominis muscles.

To what foramen does the os pubis contribute? — The obturator foramen.

Where is the angle of the os pubis? — It is situated anteriorly; formed by the junction of the body and ramus.

Where is the ramus? — It descends from its angle.

How is the acetabulum formed?[9] — One-fifth is formed by the os pubis, rather more than two-fifths by the os ischium, and less than two-fifths by the os ilium.

What is the name of the large hole formed by the ischium and pubis? — Foramen thyroidum, filled in the recent subject with a membranous ligament, except at its superior part, for the transmission of vessels, &c.

What part of the edge of the acetabulum is most prominent? — The upper part of its brim.

What portion of the acetabulum is without cartilage? — That between its middle and its inferior notch.

What is situated in that portion of the acetabulum which is uncovered by cartilage?—A ligament, synovial glands, and fat.

Where is the notch of the acetabulum situated?—Towards its lower part.

What is the use of this notch?—It transmits certain vessels, &c.

What is the use of the acetabulum?—To afford a point for the articulation of the os femoris with the pelvis.

What are the connexions of the ossa innominata?—They are connected posteriorly to the os sacrum; anteriorly to each other, forming the symphysis pubis; and laterally and inferiorly to the thigh bones.

What is the shape of the pelvis?—Conoidal.

What are the uses of the pelvis?—It affords an arch for supporting the superincumbent parts of the body, it contains the urinary bladder and rectum, and the uterus in females, besides it gives protection to large blood vessels and nerves, and gives origin and affords insertion to muscles, &c.

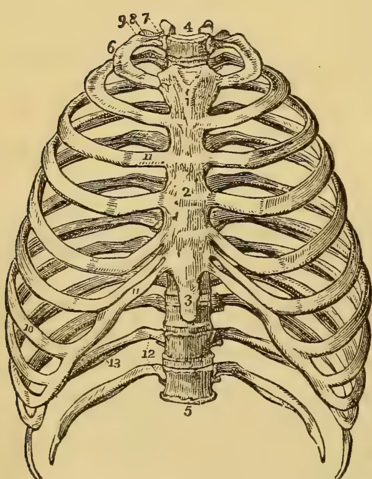
How is the pelvis divided?—Into two parts, that above the linea ilio pectinea is called the greater or false; and that below it the lesser or true pelvis.

What are the differences between the male and female pelvis?—The ossa ilia are larger and rounder, and the lesser pelvis is also more capacious in the female than in the male; the arch of the pelvis is also more arched in the female than in the male.

How much of the acetabulum does this bone form?—Two-fifths.

BONES OF THE THORAX.

Fig. 5.



By what bones is the thorax (Fig. 5.) formed?—By the dorsal vertebræ posteriorly, the ribs laterally, and sternum anteriorly.

What is the shape of the thorax?—Conical.

RIBS.

What is the situation of the ribs?—They are placed transversely and obliquely on each side of the thorax.

What is the general form of the ribs?—Arched, and of different sizes.

What is their number?—Twenty-four; twelve on each side.

Into what classes are the ribs generally divided?—Into two classes; the true and the false ribs.

What is the number of each class? — The seven superior ribs are called true; the five inferior false.

Into what parts is each rib divided?—Into the middle part or body, an anterior and a posterior extremity, the external or convex, and the internal or concave side, a superior and an inferior edge.

Where are the heads of the ribs situated?—Posteriorly, and turned towards the vertebræ.

Where is the neck of the rib? — Immediately below the head.

Where is the tubercle of the rib situated? — At a little distance from the head, on the posterior side of the rib.

Where is the angle of the rib situated? — At a little distance from the tubercle.

What is the difference between the superior and inferior edge of each rib? — The superior edge is rounded, and the inferior is sharp.

What is situated in the groove at the lower edge of the rib?[13]—The intercostal artery, vein, and nerve.

How is the head of the rib marked?[7]—With two cartilaginous surfaces, to articulate with the little cavities formed by the union of the dorsal vertebræ with each other.

How is the tubercle of the rib marked?—With a cartilaginous surface.[9]

To what is the tubercle of the rib connected? — To the transverse process of the vertebra above it.

At what distance is the angle from the tubercle of each rib? — In the first rib[6] the angle is not distinct from the tubercle; in the second it is at a small distance, and thence continues to increase to the third false rib.

What is the form of the anterior end of the ribs? — The anterior ends of the true ribs are generally enlarged, those of the inferior false ribs generally diminish, and both have a small concave depression to receive their cartilaginous elongations.[11]

Which of the ribs are the longest? — They increase in length as they descend to the seventh or eighth.

What is the relative elevation of the ends of the ribs? — The anterior extremity of each rib is lower than the posterior.

Is the anterior or posterior parts of the ribs more crooked? — The back part of each rib is more curved.

Which of the ribs are most contorted? — The third false rib, and those immediately above it.

How does the first rib differ from the rest?—In being placed horizontally, its head being connected to only one vertebra, having no groove in its lower edge, and by its being connected immediately to the sternum.

How do the eleventh and twelfth ribs[12] differ from the rest?—Eacn of their heads are connected to only one vertebra, there is no connection to the transverse processes, and no groove on their inferior edges: they are called floating.

Which of the ribs have the shortest cartilages?—The superior ribs.

Which have the longest cartilages? — The last true, and the first false rib.

What is the direction of the cartilages of the ribs?—They all bend forward, inward, and upward.

How many of the ribs are directly connected with the sternum?—The seven true ribs by their cartilages.

How many of the ribs are connected by their cartilages merely to the cartilages of others? — The three superior false ribs.

How many of the ribs are unconnected by their cartilages either to the sternum or to other cartilages? — The two inferior false ribs; and on this account have been termed by some floating ribs.

STERNUM.

Where is the situation of the sternum?—At the anterior and middle part of the thorax.

What is its form, and of how many parts does it consist? — It is oblong, and in three pieces.

What are the marks upon its superior portion? — At the superior edge internally we have a hollow for the trachea at the superior angles, depressions to articulate with the clavicles; there are lateral depressions for articulating with the first ribs, and part of the cartilages of the second.

What are the marks upon the second bone?[2] — On the outside of the second bone, the pectoral muscle is attached, to the inner side the mediastinum and the triangularis sterni are attached. There are also depressions upon the edges for the cartilages of some of the ribs.

What is the mark upon the third portion?[3]— A depression for a part of the cartilage of the seventh rib.

What is the name of the third bone? — Cartilago xyphoides or ensiformis.

What is the structure of the sternum? — Cellular.

THE HEAD AND ITS SUTURES.

How are the bones of the head divided? — Into those belonging to the cranium and those belonging to the face.

What is the general structure of the bones of the cranium? — They consist of two tables or bony plates, and an intermediate diploe.

Which of its tables is thickest? — The external table.

What is the diploe of the bones of the cranium? — It is a cellular structure, like the epiphyses of the long bones.

What is the name of the membrane covering the cranium? — Pericranium.

Enumerate the bones of the cranium? — They are eight in number: the os frontis, two ossa parietalia, two ossa temporum, os occipitis, os sphenoides, and os æthmoides.

What bones are proper to the cranium ? — Five : two parietal, two temporal, and the occipital.

What bones are common to the cranium and face ? — Three : os frontis, sphenoid, and æthmoid.

What bones are proper to the face ? — There are fourteen : two ossa nasi, two ossa lachrymalia, two ossa malarum, two ossa maxillaria superiora, two ossa palati, two ossa turbinata inferiora, the vomer, and os maxillare inferior.

What is the situation of the os frontis ? — In the anterior part of the cranium.

Where are the parietal bones ? — In the upper and lateral parts of the cranium.

Where are the temporal bones ? — In the lower and lateral parts, and partly in the base of the cranium.

Where is the os occipitis ? — In the base and back of the cranium.

In what part of the cranium is the os sphenoides ? — In the middle of the base, and partly on the sides.

Where is the os æthmoides ? — In the middle of the forepart of the base of the cranium.

Where are the ossa nasi ? — In the arch of the nose.

Where are the ossa lachrymalia, or ossa ungues ? — In the anterior part of the nasal sides of the orbits.

Where are the ossa malarum ? — In the upper part of the face.

Where are the ossa maxillaria superiora ? — In the middle of the face, constituting the upper jaw.

Where are the ossa palati situated ? — In the back of the orbits, nares, and palate.

Where are the ossa turbinata inferiora ? — In the lower part of the sides of the nares.

Where is the vomer situated ? — In the middle of the nares.

What are the sutures of the cranium ? — The sutures formed by the union of the bones of the cranium, are five in number : the coronal, the sagittal, the lambdoidal, and the two squamous.

What sutures connect the bones of the cranium and face ? — The sphenoidal, æthmoidal, transverse, and the two zygomatic sutures.

What are the sutures of the face ? — They are sixteen in number : one perpendicular nasal, two lateral nasal, two lachrymal, two transverse nasal, two external orbital, one mystachial, one transverse palatine, one longitudinal palatine, two maxillo palatine.

Where are these various sutures situated ? — The coronal suture connects the frontal and parietal bones together ; the sagittal connects the two parietal bones ; the lambdoidal connects the parietal and the occipital bones ; the squamous connects the squamous portion of the temporal to the parietal bones ; the sphenoidal sutures surround the sphenoid bone ; the æthmoid the æthmoid bone ; the transverse suture connects the facial and cranial bones ; the zygomatic sutures connect the zygomatic process of the temporal and malar bones.

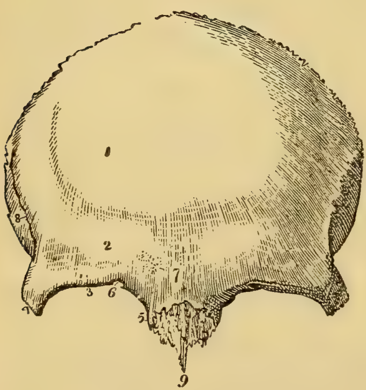
What are the locations of the other principal sutures? — We have the perpendicular nasal suture connecting the two nasal bones; the lateral nasal sutures connecting the nasal bones to the maxillary; the lachrymal connecting the lachrymal bones to the ossa maxillaria superiora; the transverse nasal connecting the ossa turbinata inferiora to the ossa maxillaria superiora; the suture at the junction of the two superior maxillary bones beneath the anterior aperture of the nostrils; the transverse palatine connecting the palatine processes of the palate bones to the superior maxillary; the longitudinal palatine connecting the palatine processes of the maxillary and palate bones of the two sides together; the maxillo-palatine connecting the palate bones to the bulbs of the superior maxillary bones.

What other connections are there about the face? — That of the vomer with the os sphenoides, and the palatine and superior maxillary bones, and those of the teeth to the two maxillary bones.

OS FRONTIS.

What is the situation of the os frontis? (Fig. 6.) — At the anterior part of the cranium, and superior part of the face.

Fig. 6.



Describe the os frontis. — It is concave internally, and convex externally; resembling, in appearance, a shell.

What are the elevations of the os frontis? — Two internal angular processes at the insides of the orbits;[5] a nasal process between these; two superciliary ridges forming arches,[2] the inner ends of which rest on the internal angular processes, and the outer ends upon the two external angular processes at the outer edge of each orbit;[4] a temporal process and ridge immediately behind the external angular process, two orbitar plates, or processes, which run back from the superciliary ridges; two bumps of the frontal sinuses, which are placed immediately above the internal angular processes[7] and eminences, some way above the middle of the superciliary ridges, which prominences were the points of its ossification:[1] — all these elevations are situated externally, except the orbital plates, which project internally, where also the spine,[9] ascending from the root of the nose to the middle of the semi-circular edge of the bone, may be seen.

What and where are the fontanels? — Unossified portions of the fœtal cranium, four in number; the anterior is the largest, kite-shaped, at the junction of the coronal and sagittal sutures; the posterior is triangular and small, situated at the junction of the lambdoidal and sagittal sutures. The other two are much smaller; the one is placed at the angle of the temporal parietal and occipital bones, the other at the junction of the temporal parietal and sphenoid bones.

Describe the ossa wormiana, or triquetra. — They are small bones with distinct points of ossification, of various shapes and numbers, sometimes situated in the sutures.

Describe the cavity of the cranium. — It is of various dimensions, which, when the arch on top is removed, presents three deep depressions or fossæ.

Describe the cavity of the orbit of the eye.—It is formed by seven bones, and of a conical shape, the foramen opticum at the apex—its base is rather circular-looking forward. The *foramen lacerum superius*, or sphenoidal fissure superior, opens into the cavity; besides this, the *foramen lacerum inferius*, formed by a fissure between the sphenoid and maxillary bones, and other orifices are observed

Where are the various attachments for muscles? — To the internal angular process internally the trochlearis is fastened, externally the corrugator supercilii; to the temporal ridges, the origin of the temporalis and its aponeurosis; to its spine the falx cerebri.

What are situated above its orbital plates? — The anterior lobes of the brain.

What are the depressions of the os frontis? — They are its orbital depressions in the orbital plates; its lachrymal depressions situated on the same plates, and behind its external angular processes; its depressions for the pulleys of the trochleari muscle on the inside of its internal angular processes; its æthmoidal fissure between its orbital plates; its temporal depressions behind its processes of the same name; the great concavity of the internal side of the bone; and a furrow along its spine.

What are situated in its lachrymal depressions? — The lachrymal glands.

What is situated in its æthmoidal fissure? — The cribriform plate of the æthmoid bone.

What are situated in its temporal depressions? — The temporal muscles.

What is situated in the furrow of its spine? — The anterior part of the longitudinal sinus: a great vein of the dura mater.

What are the foramina of the os frontis, and what do they transmit? — Externally, two, called superciliary, which transmit twigs of the ophthalmic nerves, artery, and vein; internally, one called cæcum, at the root of the spine, through which an artery and vein sometimes pass to the nose.

In the fœtal state is this bone complete? (Fig. 7.) — No: it is di-

vided into two equal parts; it contains no sinuses, and the orbital plates and superciliary ridges are deficient.

Fig. 7.

What are the connexions of this bone? — It is connected superiorly to the parietal bones by the coronal suture; posteriorly and inferiorly to the sphenoid bone by the sphenoidal suture; and inferiorly to the bones of the face by the transverse facial suture.

What are the uses of this bone? — It constitutes the forehead and upper part of the face; it supports and defends the anterior lobes of the brain; and forms a great part of the orbits of the eyes.

Describe the nasal cavities. — There are two, separated by the septum of the nose; the anterior openings upon the face are termed *anterior nares*, the posterior openings into the pharynx the *posterior nares.* There are also three passages, termed *superior*, between the superior and middle turbinated bones, opening into it, the posterior ethmoidal cells, the sphenoidal cells, and the spheno-palatine foramen; *middle*, between the middle and inferior turbinated bones, with which the frontal sinus, anterior ethmoidal cells, and antrum highmorianum communicates; *inferior*, the largest, between the inferior turbinated bones and floor of the cavity, having the nasal duct opening into it.

Describe the zygomatic or temporal fossa. — It is the large fossa on either side of the head, in which the temporal muscle is situated; it is formed by the parietal, sphenoid, and temporal and frontal bones, externally bounded by the zygomatic process.

Fig. 8.

Where is the pterygo-maxillary fissure? — At the bottom of the zygomatic fossa, formed by the sphenoid palate and superior maxillary bones; it is triangular, and contains the ganglion of *Meckel*, which distributes branches through foramina opening into the fissure: it is continuous with the *foramen lacerum inferius.*

OSSA PARIETALIA.

What are the situations of the ossa parietalia? (Fig. 8.) — They are situated at the superior and lateral parts of the skull.

Describe them.—They are quadrangular, concave internally, and convex externally.

What are the elevations and depressions?—We have a semicircular ridge nearly midway up the bone, and still higher the fœtal points of ossification. The depressions are their concave internal surface, a furrow on the inside of the upper edge, and one on the inside of the posterior angle.[8]

What muscles are attached to, and what parts occupy the various ridges and depressions?—Externally to the temporal ridge the temporal muscle is attached; internally in the furrow, in the inside of the upper edge,[1] we have a part of the longitudinal sinus;[5] in the furrow at the inside of the posterior inferior angle, a part of the lateral sinus is located; in the furrow at the anterior inferior angle, the anterior branch of the middle artery of the dura mater runs.

Where is the parietal foramen situated, and what passes through it?[6]—It is generally at the upper edge, near the posterior superior angle, transmitting an artery to the dura mater and a vein to the longitudinal sinus.

What are the connexions of these bones?—To each other by the sagittal suture, to the os frontis by the coronal suture, to the ossa temporum by the squamous sutures,[2] to the os occipitis by the lambdoidal sutures, and by their anterior inferior angles with the os sphenoides.[7]

What are the uses of these bones?—They constitute the upper and lateral parts of the skull, and protect the middle lobes of the brain.

OSSA TEMPORUM.

What are the situations of the ossa temporum? (Fig. 9.)—At the lower part of the sides and base of the cranium.

Fig. 9.

How are they divided?—Into three portions, the squamous, the petrous, and the mastoid.

What are the situations and general form of the different portions of these bones?—The more superior portions are termed squamous,[1] externally they are smooth with semicircular edges. The mastoid portions are posterior, irregularly thick, and spongy.[2] The petrous portions are inferior, and the internal are very irregular.[3]

What are the elevations of the ossa temporum?—They are the

mastoid processes, projecting downwards from the portions of that name; the zygomatic processes[4] standing outwards and forwards from the squamous portion, and having a smooth tubercle placed at the anterior inferior part of its base;[7] the styloid processes[11] projecting downwards and forwards from the petrous portion; the vaginal processes placed between the mastoid, styloid, and zygomatic; and the ridge internally on the upper part of the petrous portion.

What is the internal structure of the mastoid processes?—They are cellular.

What muscles are attached to them?—The sternocleido-mastoideus, and the trachelo-mastoideus.

What is attached to the upper edge of the zygomatic process?—The aponeurosis of the temporal muscle.

What is attached to the lower edge of that process?—A part of the masseter muscle.

What passes under that process?—The temporal muscle.

What is the use of the tubercle situated at its base?—It constitutes a part of the joint of the lower jaw.

What is attached to the styloid process?—The stylo-hyoides, the stylo-glossus, and the stylo-pharyngeus muscles. A ligament to the os hyoides, and the lateral ligament of the lower jaw, are also attached to this process.

What is attached to the auditory process?—The cartilage of the meatus auditorius externus.

What is attached to the edge of the petrous portion?—Part of the tentorium, a duplicature of the dura mater.[8]

What are the depressions of the ossa temporum?—They are the glenoid cavities for the articulations of the lower jaw; the fissura glasseri, traversing the middle of that depression; a fossa, behind the mastoid processes; a thimble-like cavity, internal to its styloid process, constituting part of the jugular foramen; a depression before its zygomatic process, called the temporal; a furrow on the inside of its mammillary portion; a furrow above, and another below the posterior surface of its petrous portion.

What is situated in the articular cavity of the bone?—Anteriorly the condyle of the jaw, and posteriorly a part of the parotid gland.

What passes through the fissure glasseri?—The laxator tympani major, and chorda tympani.

To what does the groove behind the mastoid process give attachment?—To the origin of the diagastricus muscle.

What does the jugular foramen transmit?—Posteriorly the jugular vein, and anteriorly the par vagum or pneumogastric nerve, the glosso-pharyngeal nerve, and the accessary nerve of Willis.

What is lodged in the temporal depression?—The temporal muscle.

What is situated in the furrow on the inside of its mastoid portion?—Part of the lateral sinus.

What is situated in the furrows at the upper and lower edges of

the posterior surface of its petrous portion?—The superior and inferior petrosal sinuses.

What are the foramina of the ossa temporum, and where are they situated?—Externally, the meatus auditorius externus, placed between the styloid and mastoid processes.[9] The carotid foramina at the base of the petrous portions. The stylo-mastoid between the styloid and mastoid processes. The bony Eustachian canal at the external side of the petrous portions.[14] The tensor tympani canal just before the last. The foramina mastoideum behind the mastoid processes.[8] Internally, the meatus auditorius internus on the posterior surface of the petrous portions, the opening of the aqueduct of the cochlea immediately below the meatus. The opening of the aqueduct of the vestibule on the posterior surface of the petrous portions.

What pass through these various foramina?—Through the styloid-mastoid the portio dura passes out and an artery enters. The carotid canal transmits the carotid artery and the beginning of the intercostal nerve. The mastoid foramen transmits an artery to the dura mater and a vein to the lateral sinus. The meatus auditorius internus transmits the portio dura and mollis. The Fallopian aqueduct transmits the continuation of the facial nerve. The small foramen in the superior surface of the petrous portion transmits the vidian nerve to join the portio dura.

What is the fœtal state of these bones?—There exists no meatus auditorius externus, but merely bony rings, and the styloid processes are unformed.

What are the connexions of these bones?—They are connected anteriorly to the sphenoid bone, superiorly to the parietal, posteriorly to the occipital, and to the lower jaw by a ginglymus joint.

What are the uses of these bones?—They constitute the inferior lateral parts of the cranium, support on each side the middle lobes of the brain, transmit several vessels and nerves, and contain the organs of hearing.

OS OCCIPITIS.

What is the situation of the os occipitis? (Fig. 10.)—In the inferior posterior part of the cranium.

What is its form?—Convex externally and concave internally, and irregularly rhomboidal in shape.

What are the elevations and depressions of the os occipitis?—They are the condyles;[6] a protuberance external to each of the edges of the great foramen; a longitudinal ridge in the posterior of the bone[2]; a superior[1] and inferior transverse ridge[4]; a spine in the middle of the superior transverse and the internal crucial spine.[3] The depressions are below each superior transverse ridge; one below each side of this ridge: one on the outside of each condyle, besides furrows in various portions of the bone, &c.

With what are its condyles connected?[6]—With the oblique processes of the atlas.

To what do these several prominences and depressions externally give origin and insertion? — To muscles and ligaments.

Fig. 10.

To what internally? — To the internal crucial ridge the posterior part of the falx cerebri is attached; to the lateral portions, the tentorium; to the inferior portion, the falx cerebelli.

What are situated above and below the internal lateral crucial ridges? — Above, the posterior lobes of the cerebrum are placed, and below, the lobes of the cerebellum.

What is situated in the great depression of the superior surface of the cuneiform process? — The medulla oblongata.

What are situated in the small furrows on each side of that great depression? — The inferior petrosal sinuses.

What are the foramina of this bone, and what do they transmit? — The foramen magnum[5] transmitting the medulla spinalis, the nervi accessorii, the vertebral arteries, and sometimes veins; the posterior condyloid foramen[7] transmitting the cervical nerves and lateral sinus. The anterior condyloid transmitting the ninth pair of nerves to the tongue.[9]

What is the fœtal state of this bone? — The cuneiform process, the two sides of the great foramen, and all the bone posterior to it, are easily separable in the fœtal state into four or more portions.

What are the connexions of this bone? — It is connected anteriorly to the sphenoid bone; inferiorly to the atlas; laterally to the temporal bones; and superiorly to the parietal bones.

What are the uses of this bone? — It forms the posterior and a part of the inferior portion of the cranium; it contains and defends the posterior lobes of the cerebrum, the cerebellum, and medulla oblongata; and gives exit to the spinal marrow.

OS SPHENOIDES.

What is the situation of the os sphenoides? (Figs. 11, 12.) — It passes from one temple to the other, across the middle of the base of the cranium.

What are its general divisions? — It is divided into a body situated in the middle, two alæ on each side of it; and two pterygoid portions at its inferior part.

What are the elevations of this bone? – They are the processus azygos,

standing forward and downward from its body: the posterior clinoid processes,[11] one on each side placed anterior to these; the transverse spinous processes[5] which are lateral continuations of the anterior clinoid;[8] the æthmoidal process,[2] projecting anteriorly between the two last; the orbital process, or portions of the alæ turned towards the orbits;[4] the temporal processes or portions of the alæ turned towards the temples; the spinous processes, which are posterior parts of the alæ; the styliform processes, which project downwards from the points of the spinous; the external pterygoid plate, which is the outer part of the pterygoid portions; and the internal pterygoid plate, surmounted by a hook-like process, forming the inner part of the pterygoid portion.

Fig. 11.

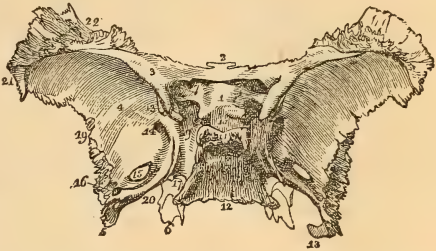
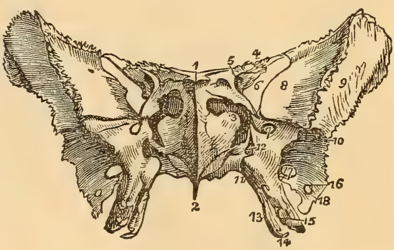


Fig. 12.



What is attached to its azygous process?—The vomer.

What is attached to the internal side of its external pterygoid plate?—The pterygoideus externus muscle.

What passes over the hook-like process of its internal pterygoid plate?—The tendon of the tensor palati.

What are the depressions of the os sphenoides?—One on each side of its processus azygos; one between its clinoid processes, called the sella turcica; a furrow on each side of it; depressions on its orbitar processes; depressions on its temporal processes; a furrow on the anterior edge of the last; a depression between the temporal processes and the pterygoid portions of the bone; the great superior concavities of the alæ; a furrow internal to the base of the pterygoid portions; a small cavity behind the base of the internal pterygoid processes; and the fossa pterygoidea between the pterygoid processes.

For what are the depressions on each side of the processus azygos?—They constitute a portion of the nares.

What is situated in the sella turcica?—The pituitary gland.

What are situated in the furrows at its sides?—The continuation of the carotid arteries.

What is situated in its temporal depressions?—The temporal muscles.

What passes in the furrow on the anterior edge of its temporal depressions?—A nerve from the superior maxillary to the temporal muscles.

What is placed in the depression between the temporal and the pterygoid processes of the bone?—The pterygoideus externus muscles.

What rests upon the internal cavity of each ala?—The middle lobe of the brain.

What passes in the furrow internal to the base of the pterygoid portion of the bone?—An artery, vein, and nerve, pass to the nares.

What is situated in the cavity behind the base of the internal pterygoid processes?—Part of the Eustachian tubes.

What is situated in the fossa pterygoidea?—The pterygoideus internus muscles.

What are the foramina of this bone, and what do they transmit?—Anteriorly we have the openings of its sinuses on each side of the processus azygos. The foramina optica transmitting the optic nerves[5] and ophthalmic arteries. The foramina lacera transmitting the third, fourth, first branch of fifth, and sixth pairs of nerves. The foramina rotunda[7] transmitting the second branch of the fifth or the superior maxillary. The foramina ovalia transmitting the third branch of the fifth pair.[17] The foramina spinosa transmitting the arteria meningea media to the dura mater.[6] The foramina vidia transmitting an artery and vein to the nose, and the vidian nerve here enters the cranium.[12]

What is the condition of this bone in the fœtal state?—In the fœtus this bone has no sinuses, and is separable from its alæ.

What are the connexions of this bone?—It is connected to the os frontis, os æthmoides, ossa malarum, ossa palati, ossa maxillaria, and to the vomer; posteriorly to the os occipitis; and laterally to the ossa parietalia.

What are the uses of this bone?—It forms a part of the sides, and a considerable portion of the base of the cranium; it supports the middle lobes of the brain; it forms a part of the orbits; it transmits numerous vessels and nerves, &c.

OS ÆTHMOIDES.

What is the situation of the os æthmoides? (Fig. 13.)—It is situated in the middle of the anterior part of the base of the cranium.

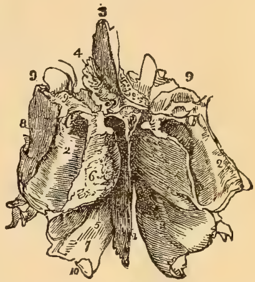
What is its general form?—It is somewhat cubical.

Of what portions does it consist?—Of a cribriform lamella,[4] nasal lamella,[1] two ossa plana, the cellulæ, and two ossa turbinata.

What is the situation of each of these portions?—The cribriform lamella is situated horizontally in the base of the cranium; the nasal lamella passes perpendicularly downward from the middle of it; the ossa turbinata[5] are situated at a little distance from the nasal lamella; the cellulæ are immediately external to the ossa turbinata; and the ossa plana are the more external of all.

What is the name of the process which rises from the cribriform lamella; and to what does it give attachment?—Crista galli,[3] and it gives attachment to the falx cerebri.

Fig. 13.



For what are the foramina in the cribriform plate?—For the transmission of the olfactory nerves.

For what are the foramina in the ossa turbinata superiora?—For the expansion of the olfactory nerves.

What are the foramina of the ossa plana;[8] and what do they transmit?—They are the foramina orbitaria interna, the anterior of which transmits the nasal twig of the first branch of the fifth pair of nerves, and a small branch of the ophthalmic artery; and the posterior a branch of the same artery.

What are the connexions of this bone?—It is joined to the os frontis, ossa nasi, ossa maxillaria superiora, ossa palati, and to the os sphenoides, by the æthmoidal suture; and to the vomer, by schindylesis.

What is the fœtal state of this bone?—In a fœtus of nine months, the crista galli and nasal lamella not being ossified the bone consists of two portions.

What are its uses?—It supports the anterior lobes of the brain; gives attachment to the falx; transmits the olfactory nerves; and forms part of the septum nasi.

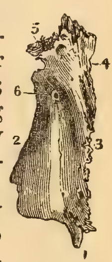
BONES OF THE FACE.

OSSA NASI.

How many nasal bones are there?—Two, (we will consider one separately.)

What is the situation of the os nasi? (Fig. 14.)—The os nasi is placed in the arch of the nose.

Fig. 14.



What is the form of this bone?—It is somewhat convex externally, concave internally, narrow in its upper part, narrower still in the middle, and broadest at the base; its root and anterior edge is thickest, the latter projecting inward to join[2,3,4,5] the septum; its outer edges superiorly are overlapped by the maxillary bones, and inferiorly overlap them; its lower edges are thin and irregular.

What are its connexions?—It is connected superiorly to the frontal bone; anteriorly to its fellow; externally to the superior maxillary bone; posteriorly to the septum narium; and inferiorly to the cartilages of the nose, and by its spinous process to the nasal lamella of the æthmoid bone.

What is its fœtal state?—In the fœtus it is proportionally shorter than in the adult.

What is its use?—It covers and defends the nares.

OSSA LACHRYMALIA.

How many lachrymal bones are there?—Two, (we will describe one only.)

What is the situation of the os lachrymale: or, as it is sometimes called, the os unguis? (Fig. 15.)—It is placed at the anterior edge of the inner side of the orbit.

Fig. 15.

What is the form of this bone?—Its external side[1] consists of a flat posterior surface and an anterior groove; its internal surface is exactly the reverse.

What is situated in its groove?[2]—The lachrymal sac.

What rests upon its flat surface?—The ball of the eye rests in part on it.

What cavities do its inner surfaces cover?—The æthmoidal cells.

What are its connexions?—It is joined to the os frontis, os æthmoides, and os maxillare, by the lachrymal sutures.[3,4,5,6]

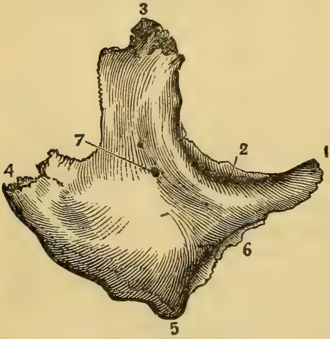
What is its fœtal state?—It considerably resembles that of the adult.

What is its use?—It forms part of the groove for the lachrymal sac and duct, and also the anterior part of the inner side of the orbit.

OSSA MALARUM.

What are the situations of the ossa malarum? (Fig. 16.)—They form the prominence of the cheeks.

Fig. 16.



What is the general form of these bones?—They are irregular in shape.

What are the elevations and depressions of these bones?—The maxillary processes; the inferior orbitar processes; the internal orbitar processes; the external orbitar processes, and the zygomatic processes.[1,3,4,5] The orbital depressions[2] and the temporal depressions.

What are lodged in the depressions?—The orbitar depression contains part of the ball of the eye, and the temporal depression part of the temporal muscle.

What are the foramina?—They have but one foramen, placed below the middle of their upper edges.

What does this foramen transmit?—A nervous twig.

What is the fœtal state of these bones?—They are fully ossified in the fœtus at nine months.

What are their connexions?—They are connected at their posterior inferior angles to the ossa temporum; at their superior orbitar process to the os frontis; at their internal orbitar process to the orbital process of the sphenoid bone; to the orbitar processes of the ossa maxillaria superiora; and at their anterior edges to the same bones.[1 2 3 4]

What are their uses?—They form the prominence of the cheek and part of the orbit, protect the temporal muscles, and give attachment to its aponeurosis.

OSSA MAXILLARIA SUPERIORA.

What is the situation of the superior maxillary bones? (Figs. 17, 18.)—They are placed at the anterior inferior part of the upper maxilla.

Fig. 17.

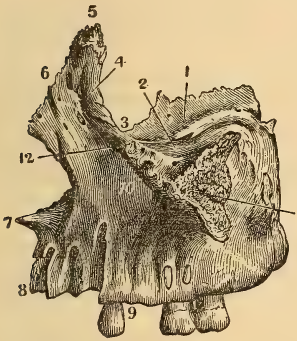
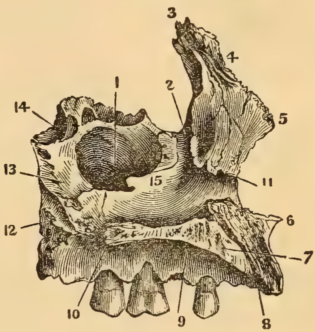


Fig. 18.



What is the general form of these bones?—Very irregular.

What are the elevations and depressions of these bones?—The alveolar processes for the teeth;[9] the palatine processes forming the floor of the nares and arch of the palate;[10] the spinous process joined to the lower edge of the septum narium; the nasal processes;[5] the bulbous processes; and the orbitar and malar processes.[11] The depressions are the palatine, and the nasal; a depression between the alveolar and malar processes;[10] the temporal depressions; the orbital depressions,[1] and the lachrymal depressions.[3]

What are the foramina of these bones, and what do they transmit?—The infra-orbital transmitting a branch of the second branch of the fifth pair of nerves, and a branch of the internal maxillary artery;[10] the foramina incisiva transmitting an artery, vein, and nerve;[8] the spheno-maxillary fissures transmitting twigs of arteries, veins, and nerves: the opening of the antrum maxillare between the turbinated bones; and the palatine foramina transmitting an artery and nerve.

Describe the situation of the antrum maxillare or highmorianum.[1] It occupies the whole inner part of the bone under the orbital plate above the dentes molares, and before the tuberosity, and is lined with a membrane.

What are the connexions of these bones?—To the os frontis;[3] ossa ungues;[4] ossa nasi;[6] ossa malarum;[11] the æthmoid bone; the ossa palati;[10] the vomer; the teeth; to the inferior turbinated bones; and to each other.

OSSA PALATI.

What is the situation of the palate bones? (Fig. 19.)—They are placed at the posterior part of the orbit, nares, and palate.

Fig. 19.

What are their general divisions?—Into the palatine, pterygoid, nasal, and orbitar processes.

What are the situations of these various divisions?—The palatine is placed at the posterior arch of the palate;[1] the nasal lamellæ posterior and external to the former; the pterygoid processes ascend from the outer edge of the palatine portions; the posterior orbitar process is connected to the base of the sphenoid bone, and the anterior one to the back of the lower side of the orbit.

What are the elevations and depressions of the ossa palati?—The spinous process and a transverse ridge on the inside of the nasal portion;[6] a depression for the nares; a palatine depression and three depressions upon the pterygoid portions.[3]

What are the foramina?—The palatine and some other small ones.

What are the articulations of these bones?—To the superior maxillary; to the pterygoid processes of the sphenoid bone; to the æthmoid bone; to the inferior turbinated bones; to the vomer, and to its fellow.

What is attached to the upper edge of the spinous process?—Part of the edge of the vomer.

What is attached to the posterior end of the spinous process?—The azygos uvulæ muscle.

What is attached to the posterior semicircular edge of the palatine portion?—The velum pendulum palati.

What is attached to the transverse ridge on the inside of the nasal lamella?—The posterior end of the inferior turbinated bones.

What is the fœtal state of these bones?—In a nine months' fœtus its form is considerably perfect.

What are the uses of the ossa palati?—They form part of the orbits, nares, and palate and of the sphenoid, æthmoidal, and maxillary sinuses.

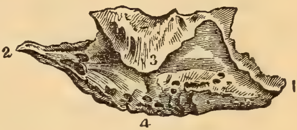
OSSA TURBINATA INFERIORA.

What is the situation of the inferior turbinated bones?—They are placed on the inner sides of the nares.

What is the form of the inferior turbinated bones?—That of a scroll forming by its processes a part of the lachrymal duct and a partial covering to the opening in the antrum highmorianum.

What is its fœtal state?—In the fœtus it considerably resembles its adult state. (Fig. 20.)

Fig. 20.



What are its connexions?—It is joined to the ossa lachrymalia,[1] ossa maxillaria superiora,[3] and ossa palati,[2] by the transverse nasal suture.[4]

What are the uses of these bones?—To give expansion to the nerves, and partly to form the antrum, and lachrymal duct.

VOMER.

What is the use of the vomer?—It is placed in the middle of the nares, and forms the posterior inferior part of the septum.

What is the form of the vomer?—It is irregular in shape, and resembles in a slight degree a ploughshare.

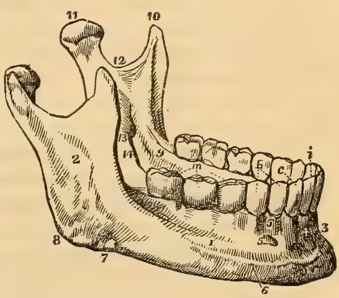
What is its consistence?—That of two lamella with a diploic structure between them.

What is its fœtal state?—In a fœtus of nine months its lamellæ are separated by cartilage.

What are its connexions?—It is connected by its anterior edge to the cartilage of the septum; to the spinous processes of the maxillary and palate bones: by its upper edge to the nassal lamellæ of the æthmoid, and processus azygos of the sphenoid bone.

What are its uses?—Its chief uses are to divide the nares, and permit the expansion of the olfactory nerves.

Fig. 21.



OS MAXILLARE INFERIUS.

What is the situation of the os maxillare inferius? (Fig. 21.)—It is placed at the lower part of the face.

What are its general divisions?—It is divided into the chin, limited by the two anterior foramina;[5] the sides extending backward from the foramina; the angles in which the sides terminate;[8] and the rami which ascend from the angles.[2]

What are its elevations?—They are the condyloid processes,[11] which is the posterior of the two arising from each ramus;[10] the coronoid processes, which are the anterior ones; a protuberance on the outer, and another on the inner side of each angle; a ridge passing externally, and another internally, from the base of the coronoid processes to the commencement of the chin; a protuberance immediately behind the symphysis of the jaw; and another on each side of the base of the chin.

What is attached to its coronoid processes?—The temporal muscles.

What is attached to the outer sides of its angles? — The masseter muscles.

What is attached to the inner sides of its angles? — The internal pterygoid muscles.

What is attached to the line[9] which passes internally from the base of the coronoid processes to the commencement of the chin? — The mylo-hyoidei muscles.

What is attached to the line which passes externally from the base of the coronoid processes to the commencement of the chin? — The buccinator muscles.

What is attached to the protuberance immediately behind the symphysis of the jaw? — The frenum of the tongue superiorly, the genio-hyoidei inferiorly, and the genio-glossi between these.

What is attached to the projections on the anterior part of the base of the chin? — The depressores anguli oris et labii inferioris.[4]

What are the depressions of the maxilla inferior? — There is one depression immediately before each condyloid process; another on each side of the anterior surface of the chin; and two on the base of the chin.

What is fixed to the depression before the condyloid processes of the jaw?—The pterygoideus externus muscles.

What is attached to the depressions upon the anterior surface of the chin? — The depressores and levatores labii inferiores muscles.

Where are the alveolar processes situated, and how many are there? —Upon the upper ridge, and contain cavities for sixteen teeth.

What is attached to the depressions on the base of the chin?—The diagastric muscles.

What are the foramina of the inferior maxillary bone, and what do they transmit? — Two foramina on each side called mental,[5] and transmit the inferior maxillary artery and vein; a branch of the third branch of the fifth pair of nerves to the teeth and chin; a small foramin on the inside of the posterior foramen, transmitting a nervous twig to the sublingual gland, and the mylo-hyoideis muscles.

What is the fœtal state of this bone? — In the fœtal state it is divided in two at the chin by a thin cartilage, hence this part has been called its symphysis.

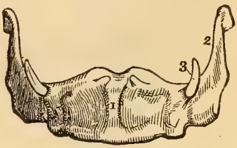
What are its connexions? — It is articulated by its condyloid processes to the temporal bone.

What are its uses? — It is useful in mastication, deglutition, and speech.

OS HYOIDES.

What is the situation of the os hyoides? (Fig. 22.) — It is placed horizontally between the root of the tongue and upper part of the larynx.

Fig. 22.



How is it divided? — Into a body, two cornua, and two appendices.

What is the form of the body?[1] — Like the Greek *v*, horizontally it is somewhat oblong; convex anteriorly, and concave posteriorly.

What is the situation of the cornua of the os hyoides?[2] — They are placed outward and backward from the body.

What is the form of the cornua? — They have two flat sides, which slope from above downwards; they diminish as they proceed backwards, and terminate in round tubercles.

What is the situation of the appendices of the os hyoides?[3] — They project upwards from the junction of the body with the cornua.

What are fixed to the appendices? — The stylo-hyoidei alteri, the condro-glossi, and a ligament to the os hyoides.

What is the fœtal state of this bone? — Except a point in the middle of its body, it is wholly cartilaginous in the fœtal state.

What are its connexions? — It is connected to the styloid processes and thyroid cartilage by ligaments.

What are the uses of this bone? — It forms a solid point for the insertion and action of the muscles of the organ of speech and deglutition.

THE UPPER EXTREMITIES.

How are the bones of the upper extremity divided? — Into those of the shoulder, the arm, the forearm, and the hand.

Of how many bones does the shoulder consist? — Of two; the scapula and clavicle.

SCAPULA.

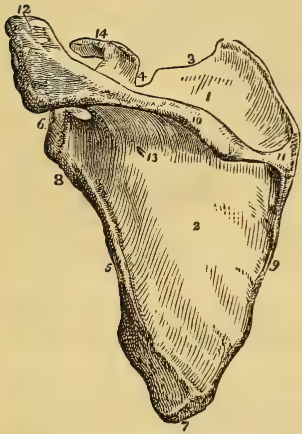
What is the situation of the scapula? (Fig. 23.) — It is placed laterally at the upper and posterior part of the thorax from about the first to the seventh rib.

What is its general form? — It is somewhat triangular.

What parts of the scapula are generally enumerated? — An external or posterior and convex side; an internal or anterior concave side; three edges, of which one is named the basis and two costa, a superior and an inferior; three angles, one anterior called the neck, one superior, and one inferior.

What are the situations of the various parts of this bone?—The base, or longest and thinnest edge is turned[9] towards the spine. The superior costa is transverse between the superior point of the base and the neck of the bone. The notch is at the anterior part of the superior costa.[4] The inferior costa is placed between the inferior point of the base and the neck.[7]

Fig. 23.



What passes through the notch?—The supra scapular vessels and nerves.

Which edge of the scapula is the thickest?—Its inferior edge or costa.[5]

How is the neck of the scapula terminated?—By a glenoid cavity.[6]

What process proceeds from the neck of the scapula?—The coracoid process.[14]

What is attached to the tuberosity of the coracoid process?—The coraco-clavicular and coraco-acromial ligaments.

What muscles arise from the tip of the coracoid process?—Three; namely, the pectoralis minor internally; the coraco-brachialis; and the short head of the biceps.

What muscle arises from above the glenoid cavity?—The long head of the biceps.

What is the appearance of the dorsum of the scapula?—Unequally convex.

What process arises from the dorsum of the scapula?—The spine of the scapula, which divides the dorsum of the scapula into two portions.[10]

What muscles are attached to the spine of the scapula?—To the superior side the trapezius muscle is attached, and the tendon plays over,[11] and from the inferior edge the deltoid muscle arises.

In what process does the spine of the scapula terminate?—The acromion process.[12]

What is the form of the acromion?—It is broad and flat.

What is attached to the upper edge of the acromion near its apex?—The scapular end of the clavicle.

What muscle arises from the inferior and anterior edges of the acromion?—The deltoid.

Into what cavities does the spine divide the dorsum of the scapula?—Into the supra-spinal[1] and infra-spinal fossæ.[2]

What muscles are situated in the two fossa?—The supra and infra-spinatus muscles.

What arises from the groove, below the infra-spinal fossa, on the inferior costa of the scapula?—The teres minor.

What muscles arise from the flat surface on the outside of the inferior angle of the scapula?—The teres major.

What muscles pass over the inferior angle of this bone?—The latissimus dorsi.

What is the appearance of the inner side of the scapula?—It is irregularly concave.

What muscle is situated on the inner side of the scapula?—The subscapularis.

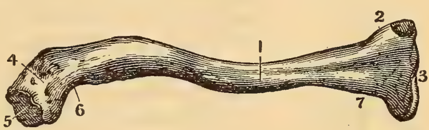
What is the general structure of the scapula?—The thicker parts of the bone possess a diploe; the thin parts have none, and are diaphanous.

What are the connexions of the scapula?—It is connected to the clavicle by the acromion, and to the os humeri by its glenoid cavity.

CLAVICLE.

What is the situation of the clavicle? (Fig. 24.)—It is placed transversely and somewhat obliquely at the upper and anterior part of the thorax, between the scapula and sternum.

Fig. 24.



What is its general form?—It has a considerable resemblance to an italic *f*.

Into what parts is it divided?—It is divided into a body, and an internal or sternal[2] and external or scapular extremity.[4]

What is the form of the sternal end of the clavicle?—It is somewhat triangular.

What is attached to the posterior angle of the sternal end?—The inter-clavicular ligament.

With what is the tubercle at the posterior part near the humeral end connected?—It is connected by a strong ligament to the coracoid process of the scapula.[6]

What is the form of the scapular end of the clavicle?—It is flat and broad.

What muscles arise from this bone, and are inserted into it?—From the anterior edge of the scapular end the deltoid arises; in the posterior edge of the scapular end the trapezius is inserted; from the anterior edge of the inner half the pectoris major arises; and in the inferior side of the clavicle the subclavius is inserted.

What is the structure of the clavicle?—The extremities are cellular; while its middle, having thick sides, possesses a narrow cavity, filled with bony filaments.

What are the connections of the clavicle?—It is connected internally to the first bone of the sternum, and externally to the acromion.

What are the peculiarities in the sexes?—In the female it is more slender, and less curved, than in the male.

OS HUMERI.

What is the situation of the os humeri? (Fig. 25.)—It is placed under the acromion, along the side of the thorax.

Fig. 25.

What is its general form?—It is irregularly cylindrical.

Into what parts is it divided?—Into a body,[1] and a superior[2] and inferior extremity.[11] [12]

What is the form and direction of the head of the os humeri?[2]—It is formed by a round, smooth head, and inclines obliquely inward.

Where are the tuberosities situated, and how are they distinguished?—Externally and inferior to the head of the bone; the one is called the internal or small,[5] and the other the external or great tuberosity.[4]

What muscles are inserted into these tuberosities?—Into the internal tuberosity the subscapularis muscle is inserted, and into the great tuberosity the supra-spinatus, infra-spinatus, and teres minor muscles are inserted.

What is situated between these tuberosities?—A very considerable groove,[6] through which the tendon of the long head of the biceps passes.

What is called the neck of the humerus?—The slight circular depression immediately below its head.[3]

What arises from the posterior part of the neck? The internal head of the triceps.

What is inserted into the ridge external to the groove?[7]—The pectoralis major muscle.

What is inserted into the ridge internal to the groove?[8]—The latissimus dorsi and teres major muscles.

What is inserted into the great muscular depression on the outer side of the middle of the os humeri?[9]—The deltoid muscle.

What is inserted into the ridge on the inner side of the middle of the os humeri?[10]—The coraco brachialis.

At what part, and in what direction, does the medullary artery of this bone enter?—It enters about the middle of the anterior side of the bone, and slants downward.

What is the form of the lower part of the os humeri?—The lower extremity becomes gradually flatter and broader than the rest of this bone; having also an outer[15] and an inner edge[16] which terminates in two processes, which are called the outer[13] and inner condyles.[14]

Which of the condyles is the larger?—The inner one, which is also the more projecting.

What muscles generally arise from the external condyle?—The two extensors and supinators of the hand.

What muscles arise from the internal condyle?—The flexors and pronators of the hand.

Where is the trochlea of the os humeri situated?—Between and somewhat below the two condyles.

What is the form of the trochlea?—It is an oblique, pulley-like articular surface; and a small, round, articular head [11] is placed between it and the outer condyle.

What is the form of the os humeri immediately above the trochlea?—Above these parts there are two slight depressions anteriorly, and a very considerable one posteriorly.

To what are the depressions above the trochlea adapted?—The posterior one receives the olecranon when the arm is extended; the inner anterior one receives the coronoid process of the ulna;[17] and the outer anterior one receives the round head of the radius in the flexions of the forearm.

What is the particular situation of the os humeri?—In its natural situation the hemispherical head of this bone is turned inwards and backwards; the great tuberosity outward and forward; the groove between the two tuberosities directly forward; the external condyle forward and outward; and the internal condyle backward and inward.

What is the structure of the os humeri?—The extremities are cellular; the external surface of the diaphisis is compact, and the middle has a tubular cavity, with several bony filaments passing across it.

What are the connexions of the os humeri?—It is connected superiorly with the glenoid cavity of the scapula; and inferiorly with the ulna by its trochlea; and with the radius by its little round head.

ULNA.

Of how many bones does the forearm (Fig. 26.) consist?—Of two; the ulna and radius.

What is the situation of the ulna?—On the inner side of the forearm.

What is its form?—Cylindrical, and in its circumference irregularly triangular.

How is it divided?—Into a body and two extremities.

What are its chief eminences?—The olecranon and coronoid processes.

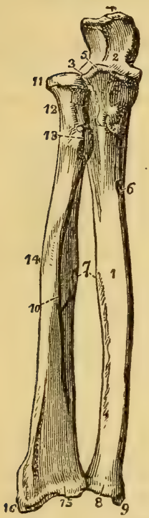
What is the situation of the olecranon?[4]—It forms the upper extremity of this bone.

What muscle is inserted into it?—The triceps extensor cubiti.

Where is the coronoid process?[5]—On the anterior part of the bone somewhat lower than the olecranon.

What muscle is inserted into it?—The brachialis internus.

Fig. 26.



Where is the olecranon lodged when the forearm is extended?—It is lodged in the posterior depression of the inferior end of the humerus.

Where is the coronoid process lodged during the flexion of the forearm?—It is lodged in the anterior and inner depression of the lower end of the humerus.

What is the use of the triangular surface on the posterior part of the olecranon?—It forms the part of the elbow on which we rest.

What is lodged in the fossa external to the triangular surface?—The anconeus muscle.

Where is the greater sigmoid[2] cavity of the ulna?—It is in articular surface formed between the olecranon and coronoid processes, and is used as an articulation with the trochlea of the os humeri.

Where is the lesser sigmoid[3] cavity?—It is situated on the outside of the root of the coronoid process, and receives the round head of the radius.

What is attached to the outer sharp edge[7] of the ulna?—The interosseous ligament.

What is the situation of the canal for the medullary artery of the ulna?—It is placed about the middle of the anterior part of the bone, and slants upward.

What is the form of the inferior extremity of the ulna?—It has a small head externally,[8] and a styloid process internally.[9]

What is attached to the styloid process?—A ligament from the os pisiforme and cuneiforme.

What passes in the groove on the anterior side of the termination of the ulna?—The ulnar artery and nerve.

What passes in the groove on the posterior side of its termination?—The tendon of the extensor carpi ulnaris.

What is the structure of the ulna?—Its structure resembles that of the os humeri.

What are the connexions of the ulna?—It is connected superiorly with the pulley of the os humeri; laterally with the two extremities of the radius, and with the os cuneiforme.

RADIUS

What is the situation and form of this bone?—It is on the outer side of the forearm, and of a cylindrical form.

What are the relative lengths of the radius and ulna?—The radius is the shorter.

How is the radius divided?—Into a head, body, and base.

Describe this bone?—It is slightly triangular in shape; the upper part of its head is concave and its circumference is cylindrical.[11] It articulates laterally with the lesser sigmoid cavity of the ulna. On

the anterior inner side we have its tuberosity[13] just below the neck; there is a sharp edge on the inner side for attachment of the interosseous ligament. About the middle of the bone the medullary artery enters. The lower end[15] is the largest, and has grooves passing over and under it for the flexor and extensor tendons, and a small process of bone called styloid at the outer inferior side.

What is received into the depression on the inner side of the base of the radius?—The inferior head of the ulna.

What is attached to the styloid process?[16]—A ligament connecting it to the trapezium.

What is the structure of the radius?—It resembles that of the other long bones.

What are its connexions?—It is joined superiorly to the os humeri, laterally to both sides of the ulna, and inferiorly to the bones of the carpus.

BONES OF THE HAND.

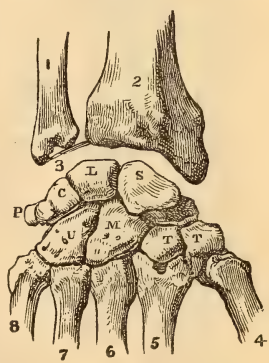
How are the bones of the hand classed?—Into the carpus, metacarpus, and phalanges of the fingers.

CARPUS.

Describe the carpus? (Fig. 27.)—It forms the wrist, and consists of eight bones arranged in two rows, and is of a quadrangular form, convex externally, and concave internally.

What are the names of the carpal bones?—Those of the upper row are the os scaphoides,[S] os lunare,[L] os cuneiforme,[C] os pisiforme;[P] those of the lower row are the os trapezium,[T] os trapezoides,[T] os magnum,[M] and os unciforme.[U]

Fig. 27.



What are the situations and general forms of each of the bones of the first row?—The os scaphoides is the most external bone of the first row, and is convex superiorly and concave inferiorly, and is oblong in shape. The os lunare is the second bone of the first row, and is convex superiorly and concave inferiorly, and its two surfaces are roughened. The os cuneiforme is the third bone of of the first row, the upper surface is convex; it has a small plane on its anterior surface for the os pisiforme and articular facets for the lunare and unciforme. The os pisiforme is the fourth bone, and placed on the anterior side of the cuneiforme; it is the smallest bone of the wrist.

What are the situations and general forms of each of the bones of the second row?—The os trapezium is the first external bone of this row; it is irregular in shape, and has an oblong eminence on its inner

surface for the carpal ligament — a groove for a tendon; the upper side articulates with the os scaphoides; the lower side articulates with the first metacarpal bone, with the thumb and with the os trapezoides. The os trapezoides is the second bone of the row, and articulates superiorly with the os scaphoides, inferiorly with the base of the first metacarpal bone, on the radial side with the trapezium, and on the ulna side with the os magnum. The magnum is the third bone, and articulates superiorly with the scaphoides and lunare, inferiorly with the second metacarpal bone; on the radial side, to the os trapesoides, and on the ulnar side to the os unciforme. The os unciforme is the fourth bone, there is a hook-like process on its anterior surface; the posterior surface is rough, the radial side is double, corresponding to the os magnum; the superior side corresponds to the inferior one of the os cuneiforme, and the inferior side is double for the articulation with the last bones of the metacarpus.

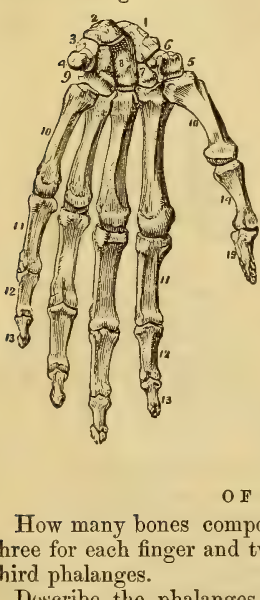
What is the structure of the carpal bones? — Spongy.

METACARPUS.

What is the situation of the metacarpus? (Fig. 28.)— Immediately below the carpus, and consists of five bones.

What is the general form and division of the metacarpal bones? —They are long bones; thicker at the extremities than at the middle, and are divided into a body and two extremities.

Fig. 28.



What is the form of the bodies and extremities? — The bodies are contracted and triangular, posteriorly convex, and anteriorly they are marked with a sharp edge on the sides; the extremities are rounded and flattened, with eminences on the sides.

Which is the longest of the metacarpal bones? — The second, which supports the forefinger.

What is their structure? — They resemble the long bones.

What are their connexions? — They are connected superiorly to the bones of the carpus; laterally to each other by their basis; and inferiorly to the first bones of the fingers.

OF THE FINGERS.

How many bones compose each finger and thumb? — There are three for each finger and two for the thumb, called first, second, and third phalanges.

Describe the phalanges? — They vary in length, and are rounded

on the upper side and flat on the lower, and their heads present various surfaces, for articulation with each other and with the carpal bones; the third phalanges are the smaller of the three.

OF THE LOWER EXTREMITIES.

How are the bones of each lower extremity divided? — Into the os femoris, or thigh-bone; the tibia; fibula; and patella, or leg-bones; the tarsus; metatarsus; and phalanges of the toes, or foot.

OS FEMORIS.

Where is the os femoris situated? (Figs. 29, 30.) — Between the trunk and the leg.

How is it divided? — Into a body and two extremities.

What are the peculiarities of the superior extremity of this bone? —It has a head or spherical portion[2] and two trochanters —the great[4] and small.[6] The head is supported upon a neck[3] projecting inwards and upwards at an angle of 35°. The trochanters are tuberosities at the base of the neck, of various heights.

Fig. 29.

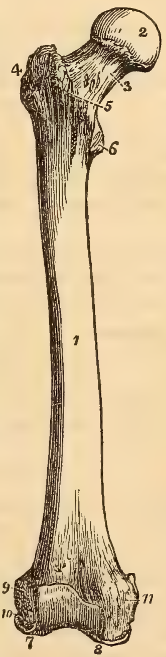
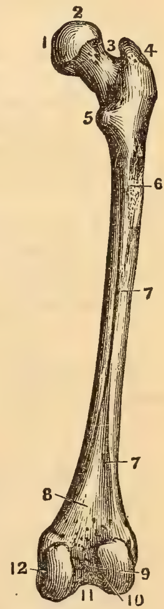


Fig. 30.



What is peculiar to the head of the bone?—It is the articular portion, and has a small fossa near its centre for the attachment of the ligamentum teres.

What muscles are inserted in the greater trochanter? — Externally the tendon of the gluteus maximus covers it. The gluteus minimus is attached to the anterior muscular mark, and posteriorly the quadratus femoris is inserted. The gluteus medius, the pyriformis, the obturator internus, and the gemini also find places for attachment in the sharp superior edge; while in the deep fossa along side, the tendon of the obturator externus plays.

What is the form of the body[1] of the os femoris?–It is cylindrical.

What is attached to the trochanter minor? — The iliacus internus and psoas muscles.

Where is the linea aspera? — It is the rough prominent line passing along the posterior part of the os femoris.[7]

What muscles are attached to the linea aspera?—At its commence-

ment the gluteus maximus is inserted, at its middle the triceps is inserted, and the short head of the biceps arises.

What are the peculiarities of the two ridges which pass externally and internally from the linea aspera? — To the outer ridge the vastus externus is attached, and to the inner ridge the vastus internus and the aponeurosis of the great head of the triceps is attached, and over the internal ridge the femoral vessels pass.

What is inserted into the tuberosity which terminates the inner ridge of the linea aspera?—The tendon of the great head of the triceps.

What is the situation and direction of the canal of the medullary artery? — About the middle of the linea aspera, and slants upwards.

What is the form of the lower extremity of the os femoris? — It is broad and thick; formed by two large protuberances projecting downward and backward.

What are the names of these protuberances? — The condyles of the os femoris.

How would you distinguish the inner from the outer condyle?—The inner one projects[8] most inferiorly and posteriorly, while the outer one projects anteriorly.

What is situated between the two condyles posteriorly? — A deep notch.[10 11]

What is transmitted through this notch? — The vessels from the thigh.

What ligaments are attached to the inner side of this notch?—The crucial ligaments.

Where is the pulley of the os femoris situated? — The junction of the condyles anteriorly forms a pulley-like surface on which the patella rests.

What are attached to the small tuberosities immediately above the back of the condyles? — The heads of the gastrocnemius.[8]

What is the structure of the os femoris? — Its structure resembles that of other long bones.

OF THE LEG.

Of what bones does the leg consist? — It consists of three bones; namely, the tibia, fibula, and patella.

TIBIA.

How is the tibia (Fig. 30.) situated?— It is placed on the inner side of the leg.

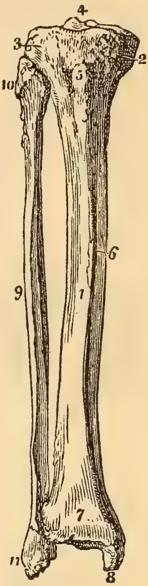
What is its general form? —Its circumference is irregularly triangular; and larger above than below.

How is it divided? — Into a body, an upper and lower extremity.

What is peculiar to the head of this bone? — It is thick and expanded, and has two broad articular surfaces, the one external, and the other internal; the internal one is oblong and depressed, and the external one rounder.

What are attached to the tuberosities at the head of the bone?—To the tuberosity[4] between the superior articular surfaces the cervical ligaments are fastened, and to the tuberosity[2] behind the inner part of the head of the tibia the semimembranous muscle is attached, and to the tuberosity behind the outer part of the head of the tibia, the head of the fibula articulates.[10] To the tuberosity on the fore part of the bone, the ligament of the patella is fixed.[5]

Fig. 31.



What is the form of the body[1] of the tibia?—It presents three distinct surfaces and edges.

What is the structure of the tibia?—Like the other long bones.

What is attached to the inner edge of the tibia?—The interosseous ligament.

What is the situation and direction of the canal of the medullary artery?—It is situated somewhat above the middle of the posterior side of the bone, and slants downward.

What is the form of the lower part of the tibia?—It is much smaller than the upper part.

What is the use of the notch on the outside of the lower end of the tibia?—It is a longitudinal depression for the end of the fibula.

What is the name and use of the process on the inside of the lower end of the tibia?—It is called its malleolous internus, and gives attachment to a strong ligament.[8]

How is the trochlea which receives the astragalus formed?—By the lower end of the tibia and its malleolous internus, together with the lower end of the fibula or malleolous externus.[11]

What are the connexions of the tibia?—It is joined superiorly to the os femoris and patella: latterly to the fibula, both above and below; and inferiorly to the astragalus.

FIBULA.

What is the situation of the fibula?—On the outside of the leg.[9]

What is its form?—Long, slender, and triangular.

How is it divided?—Into a body; and an upper and lower extremity.

What is the form of the two ends of the bone?—The upper end is obliquely flattened, and has a small articular plane internally, and externally there is a small tuberosity; the lower end is broader, flatter, and more oblong than the superior one.

What are attached to the two ends?—To the upper end, into the tuberosity, the tendons of the biceps is inserted and the external late-

ral ligament, and it is also articulated to the tibia. To the inferior extremity of the bone, ligaments are attached to strengthen its attachment with the astragalus, &c.

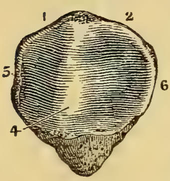
To what part of the body of the fibula is the interosseus ligament fixed?—To the inner side.

What is the situation and direction of the canal of the medullary artery of this bone?—It is placed about the middle of the posterior side of the bone, and slants downwards.

What are the connexions of this bone?—It is connected laterally to the tibia, both above and below, and inferiorly to the astragalus.

PATELLA.

Fig. 32.



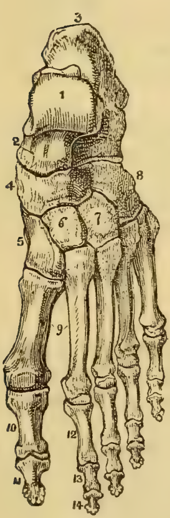
What is the situation of the patella? (Fig. 32.)—It is situated directly above the anterior tuberosity of the tibia.

What is its general form?—Oval and thick.

How is it divided?—Into a basis, an apex,[1 2] and two sides.

What are attached to the patella?—Superiorly the conjoined tendons of the vasti, rectus femoris, and cruralis are fastened, and below the ligament of the patella.[3]

Fig. 33.



What is the appearance of its inner or posterior side?—It is somewhat concave, and divided into two by a middle ridge.[5 6]

Which of its depressions is the deeper?—The more external one.

What is the structure of this bone?—It is of a spongy structure.

What are its connexions?—It is connected to the anterior tuberosity of the tibia by a strong ligament, and is articulated with the pulley and condyles of the femur.

OF THE FOOT.

How are the bones of the foot divided? (Fig. 33.)—Into three classes; namely, those of the tarsus, metatarsus, and toes, or phalanges.

TARSUS.

What is the situation of the tarsus?—At the posterior part of the foot.

Of what bones does the tarsus consist?—It consists of seven bones: namely, the astragalus;[1] os calcis;[3] os scaphoides;[4] os cuboides;[8] and the three ossa cunciforma, viz.: the internum,[5] medium,[6] and externum.[7]

Which is the superior bone of the tarsus?—The astragalus, which, with the bones of the leg, forms the ankle joint.

Describe the astragalus.—It is very irregular; it has a body or posterior portion; an anterior portion or apophysis;[2] the superior portion resembles a pulley; the inferior surface has two articular facets divided by a groove.

With what does this bone articulate?—With the os calcis, the os naviculare, and with the tibia and fibula.

What is the situation of the os calcis?—It is placed at the posterior and inferior part of the tarsus, and forms the heel.

What is the appearance of the os calcis?—It is irregularly oblong. The superior surface is divided by a groove, posteriorly it is broad, convex, and rough; on its lower surface it is narrow and rough; anteriorly it has a concave articular surface, and on the inner side it is concave.

What is attached to its rough portion at its posterior end?—The tendo Achilles.

What is attached to its anterior side?—The os cuboides.

What is the situation of the os scaphoides?—It is placed immediately before the astragalus.

What is its form?—It somewhat resembles a small boat; and has an anterior and a posterior cartilaginous surface, an oval circumference, and an inferior tuberosity.

What are attached to its various surfaces?—To the inferior concave side the head of the astragalus is fixed; to the anterior convex side the three ossa cuneiformia are attached; and to the tuberosity is fixed a portion of the tendons of the abductor pollicis and tibialis anticus muscles.

What is the situation of the os cuboides?—It is situated before the os calcis on the outside of the os naviculare.

Describe it.—It has six irregular sides, the inferior one is rough and has a well marked groove upon it: the posterior and anterior surfaces are articular; the inner side has a round cartilaginous surface, and the remainder is rough; the outside is irregular, short, and narrow, and the upper side is flat and rough.

What are the articulations of this bone?—Anteriorly to the os calcis, to the fourth and fifth metatarsal bones, and to the os cuneiforme externum by the inner side, and to the cartilaginous surface, the os cuneiforme externum is attached.

What is the situation of the ossa cuneiformia?—Before the os scaphoides, and internal to the os cuboides.

What is the relative size of the ossa cuneiformia?—The internal is the largest, and the external is the least.

How are they divided?—Each cuneiforme bone has a base superiorly, an apex inferiorly, and a posterior, an anterior, an external, and an internal side.

What is the form of the os cuneiforme internus?—It somewhat

resembles a wedge contorted and bent, and has it base turned downward.

What is the form of the os cuneiforme medium?—It more resembles a wedge, and has its base turned upward.

What is the form of the os cuneiforme externum?—It also resembles a wedge, and has its base turned upward.

METATARSUS.

What is the situation of the metatarsus?—At the middle part of the foot.

Of how many bones does the metatarsus consist?—Of five bones;[9] one supporting each toe.

What is the form of the metatarsal bones, and how may they be divided?—They are long and slender, and flattened on each side, and are divided into a body, basis, and head.

Describe them.—The bases are wedged-shape; their bodies are long, slender, and flattened, and the heads are convex and smooth, and flattened laterally.

Which is the largest of the metatarsal bones?—The first one.

What is peculiar to the fifth metatarsal bone?—It is distinguished by a rough projection from its base, to which is attached the peroneus brevis muscle.

What are the connexions of the metatarsal bones?—They are joined to the tarsus, and to each other posteriorly, and to the first phalanges of the toes anteriorly.

OF THE TOES.

What is the number of the bones of the toes?—The five toes are formed by fourteen bones; three belonging to each of the four lesser [12 13 14] toes, and two to the great toe.[10 11]

How are they arranged?—They are arranged precisely as the fingers.

What is the form of the first bone of the great toe?—It somewhat resembles the second bone of the thumb. Its base is considerably hollow, and its head resembles a pulley.

What is the form of the second bone of the great toe?—It resembles the last of the thumb, but is much larger, and its anterior edges more unequal.

What is the form of the first bones of the other toes?—The first bones of the other toes are the largest, but are shorter, narrower, and more convex than those of the fingers.

What is the form of the second bones of the toes?—They are very short, and almost of the same oblong form.

What is the form of the third bones of the toes?—They nearly resemble those of the fingers.

What is the form and situation of the sesamoid bones? — They are small oval bones, chiefly found under the first joint of the great toe.

OF ARTICULATIONS IN GENERAL.

What are the articulations of bones? — The connexion of bones with each other are called articulations, and are divided into three classes.

What are the general classes of articulations? — Symphysis, synarthrosis, and diarthrosis.

What is symphysis? — Symphysis expresses the substance connecting bones, amphiarthrosis.

What is synarthrosis? — The immovable connexion of bones, sutura, harmonia, schyndylesis, gomphosis.

What is diarthrosis? — The movable connexion of bones, arthroida, ginglymus, enarthrodia.

OF CARTILAGES.

What are cartilages? — White, elastic, smooth, and compact substances; in density next to bone, chemically consisting of gelatine, water and phosphate of lime. The gelatine is dissolved by boiling, they resist putrefaction longer than any other structure excepting bone. Cells are distinguished in them by the microscope.

How many kinds of cartilages are they? — Four kinds, viz., 1st, diarthroidal, or those covering the heads of bones and forming joints; 2d, synarthroidal, or those placed between bones, as in the pubis, and forming a union of parts; 3, interarticular, or those in some joints between bones, as in the joint of the lower jaw, to prevent too great friction, &c.; 4th, those which supply the place of bone, as in the larynx, trachea, and parts of the chest.

What is the perichondrium? — The membrane which invests all the cartilages with the exception of the articular ones, and is fibrous in structure.

Have cartilages canals or cells in them, as bones? — No.

How are cartilages divided? — Into permanent and ossific.

Are bloodvessels and nerves conspicuous in cartilages? — No.

Have they much sensibility? — Not in their healthy state.

In what parts of the body does cartilage supply the place of bone? — In the nose, larynx, ends of the ribs, and on the edges of the articular cavities.

Where do cartilages perform the offices of cartilage and ligament? Between the vertebræ of the spine and the bones of the pelvis.

LIGAMENTS GENERALLY.

What are the ligaments? — Strong, flexible substances, usually connecting those bones together, which form movable joints, and are composed of longitudinal and obliquely transverse fibres.

Have they blood-vessels and nerves? — Yes.

Have they much sensibility? — Not in their healthy state.

How many kinds of ligaments are there? — There are two kinds; 1st, the capsular; 2d, the connecting ligaments, or funicular cord-like, and membranous, or riband-like expansions.

Describe the capsular ligaments? — They surround joints on all sides, and form sacs to retain the synovial membrane, and form a union of the bones.

What are connecting ligaments?—They are firmer and more fibrou than the capsular, and strengthen the union of bones, as in the case of the lateral, crucial and round ligaments, &c.

What other kinds of ligamentous substances are there? — Some answering the purposes of bones, others strengthening the union of bones, not moving on each other; these two kinds may be found about the pelvis. A third kind are the elastic ligaments; they exist about the vertebræ, in some animals they are very common; of this nature is the ligamentum nuchæ in the necks of grazing animals.

What lubricates the articulations and facilitates their motions? — The synovial fluid secreted by the synovial membrane lining the capsular ligaments, &c., and also small fatty substances placed in the joints.

LIGAMENTS OF THE LOWER JAW.

What is the structure of the articulations of the lower jaw? (Figs. 34, 35, 36.) — It is formed by the condyles of the lower jaw and the glenoid cavities of the temporal bones, a thin cartilage covers each surface,[3] and a capsular ligament surrounds each, besides four lateral

Fig. 34.

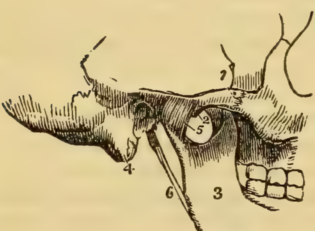
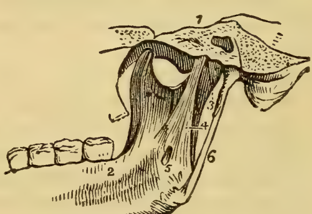


Fig. 35.

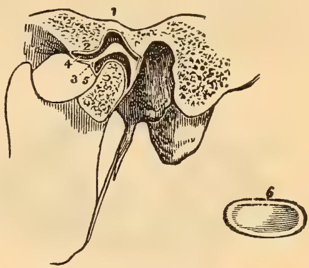


ligaments, we have interarticular cartilages[3] and two synovial membranes,[4,5] the one being reflected between the glenoid cavity and interarticular cartilage, and the other between the cartilage and condyle of the jaw. (Fig. 36.)

What are the ligaments of the lower jaw? — Besides the capsular we have two external lateral ligaments,[5] the one rising from the in-

ferior margin of the root, of the zygomatic process of the temporal bone, and from the anterior side of the meatus externus, and is inserted into the neck of the condyloid process. The other arises from the anterior part of the inferior margin of the zygomatic process of the temporal bone, and is inserted into the neck in advance of the other. The internal ligament arises from the extremity of the spinous process of the sphenoid bone, and from the processus vaginalis of the temporal bone, and is inserted into the spine bordering the posterior mental foramen.[3] The stylo-maxillary ligament[6] arises from the external side of styloid process, and is inserted into the posterior margin of the jaw near its angle.

Fig. 36.



LIGAMENTS OF THE SPINE.

What are the ligaments of the vertebræ in general? — For the union of the vertebræ there are seven kinds of ligaments; namely, the common anterior ligament, common posterior, crucial or intervertebral, the capsules of the oblique processes, intertransverse, flava, interspinous, and intervertebral substance.

What is the intervertebral substance? — The substance uniting the bodies of the true vertebræ together, formed of intervertebral matter of concentric lamellæ of a ligamentous texture, with a pulpy substance in the centre.

What is the situation of the common anterior ligament of the vertebræ?—It arises from the fore part of the first vertebra, and covers the anterior part of the whole spinal column as far down as the os sacrum.

What is the situation of the common posterior ligament? — It arises from the anterior part of the foramen magnum, and covers the posterior part of the bodies of the vertebræ to the termination of the os sacrum.

Where are the crucial or intervertebral ligaments? — They cross each other obliquely from the edge of one vertebra to that of another.

Where are the capsules of the oblique processes? — They arise from the edge of one oblique process and surround that of the other which is contiguous.

What is the situation of the intertransverse ligaments? — They pass between the transverse processes of the vertebræ.

Where are the ligamenta flava? — They connect the bony arches of the vertebræ.

Where are the interspinous ligaments? — They connect the spinous processes of the vertebræ.

What are the ligaments peculiar to the cervical vertebræ? — The

ligamentum nuchæ common to all the vertebræ of the neck, and arising from the spine of the occiput, and attached to the spines of all the cervical vertebræ. The transverse ligament passing from a small tuberosity behind the anterior arch of the atlas, and enclosing the tooth-like process of the dentatus. (Figs. 37, 38.)

Fig. 37.

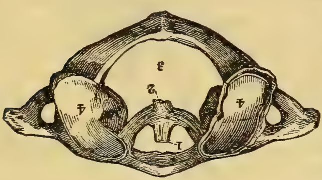
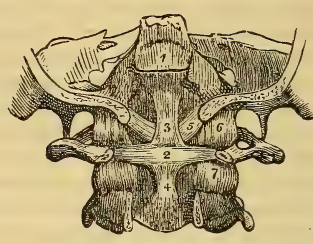


Fig. 38.



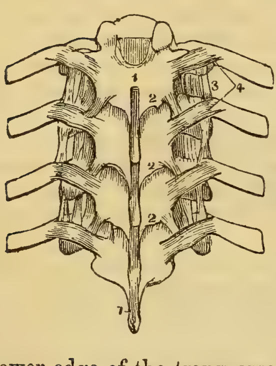
What are the ligaments from the first vertebra to the occiput? — Those of the anterior and posterior arches of the atlas and the capsular ligaments for the condyles.

What are the ligaments of the second vertebræ? — 1st. The perpendicular, arising from the tip of the tooth-like process, and inserted into the edge of the foramen magnum.[1] 2d. The lateral, arising from the sides of the processus dentatus and inserted into the occiput before the condyles, and also into the atlas.[5]

Where is the transverse ligament situated?[2] — Behind the processus dentatus, and divides the ring of the atlas into two unequal parts.

What are the ligaments between the ribs and the vertebræ? (Fig. 39.) — Between each rib and vertebra proper, we have the anterior ligament arising from the margin of the head of the rib and diverging towards the spine, and is fastened by its superior fibres to the vertebra above, by its inferior fibres to the vertebra below, and by its middle fibres to the intervertebral substance; the interarticular ligament passes from the ridge on the head of the rib to a line in the intervertebral substance. There are also synovial membranes at this junction. The tubercle of the rib is attached by a capsular ligament to the transverse processes. Also by the internal costo-transverse,[4] passing from the lower edge of the transverse process and inserted in the edge of the neck of the rib below. Also by the external costo-transverse[3] between the transverse process, and contiguous rib and by the middle costo-transverse, directly from transverse process to the rib.

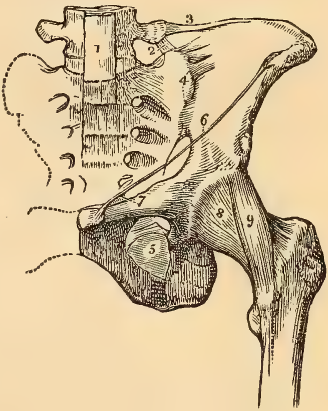
Fig. 39.



What are the proper ligaments of the sternum? — There are two; viz.: the common membrane of the sternum, and the ligaments of the xiphoid cartilage.

What are the ligaments of the pelvis? (Fig. 40.) — The anterior and posterior coccygeal ligaments; the ilio-lumbar ligaments[3] arising from the transverse process of the last lumbar vertebra, and from its inferior oblique process, and inserted into the crista of the ilium at its back part; the sacro-iliac junction formed by the corresponding surfaces of the sacrum[4] and ilium, incrusted by their own cartilage; the sacro-spinous ligament arising from the posterior superior spinous process of the ilium, and inserted into the third and fourth transverse processes of the sacrum.

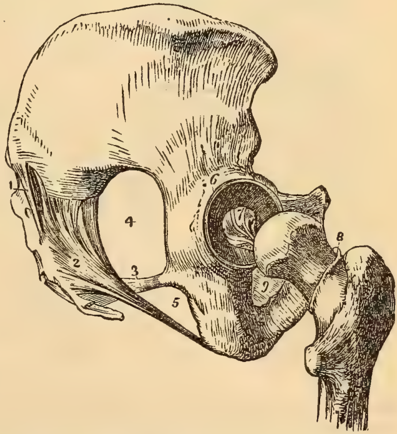
Fig. 40.



What is the situation of Poupart's ligament?[6] — It arises from the anterior superior spinous process of the ilium, and is inserted into the angle of the pubis. Some of its fibres are inserted also into the pubis before it reaches the angle.

What other ligaments are there? (Fig. 41.) — The posterior sacro-ischiatic,[2] arising from the posterior inferior spine of the ilium, from the margin of the sacrum and from the coccyx, and passes down to be inserted into the tuberosity of the ischium; the anterior sacro-sciatic ligament arises from the sacrum and coccyx, and is inserted into the spine of the ischium[3]; and the obturator ligament,[9] filling the obturator foramen.

Fig. 41.



What are the articulations of the pubis? — Between the bodies of the ossa pubes, there exists a junction by fibro-cartilaginous matter. There is also the anterior pubic ligament, consisting of in-

distinct fibres of cartilage passing from one bone to the other. The sub-pubic ligament passes from the margin of the ends of the pubis of the one side to a corresponding line on the other, &c.

LIGAMENTS OF THE UPPER EXTREMITY.

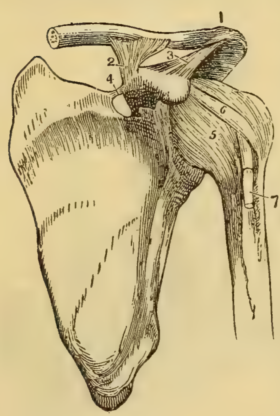
What is the sterno-clavicular articulation? (Fig. 42.)—The two surfaces of the sternum and clavicle are covered with cartilages and the joint is invested with a thick fibrous capsule. We have also an interclavicular ligament[2] extending from one clavicle to the other, and an interarticular fibro-cartilage,[4] separating the bones from each other. There are two synovial capsules in this joint, one on each side of the interarticular cartilage.

Fig. 42.

Of what does the costo-clavicular ligament consist?—Of short fasciculi of ligamentous fibres, called the rhomboid ligament,[3] arising from the upper surface of the cartilage of the rib, and implanted into the roughness on the inferior face of the clavicle near its sternal end.

What are the ligaments connecting the clavicle and scapula? (Fig. 43.)—The capsular, the conoid, and the trapezoid.

Fig. 43.



What is the situation of the capsular ligament?[1]—It arises around the sternal end of the clavicle, and is fixed round the articular surface of the acromion.

Where is the conoid ligament?[2]—The conoid or coraco-clavicular ligament arises pointed from the root of the coracoid process, and is inserted into the inferior side of the clavicle.

Describe the situation of the trapezoid ligament.—It differs in form from the last, but has nearly the same origin and insertion.

What are the ligaments proper to the scapula?—The anterior and posterior.

Describe the anterior.—It arises from the upper edge of the acromion, and is inserted into that of the coracoid process; it is also called the coraco-acromial ligament.[3]

What is the situation of the proper posterior or coracoid ligament?—

It arises from the root of the coracoid process, and passes over the notch to the superior costa of the bone.[4]

What are the ligaments connecting the scapula and humerus?—The capsular and the upper part of the tendon of the biceps muscle.[7]

Describe the capsular ligament,[5] and how has it been in part designated. — It arises from the margin of the glenoid cavity, and is inserted round the neck of the humerus — it has received the name of coraco-humeral[6] where the fibres are thickest.

What is the situation of the tendon of the biceps muscle?[7] — It arises from the upper edge of the glenoid cavity, passes through the joint, and being fixed in its groove by a strong sheath, it contributes to strengthen the shoulder joint.

Fig. 44.

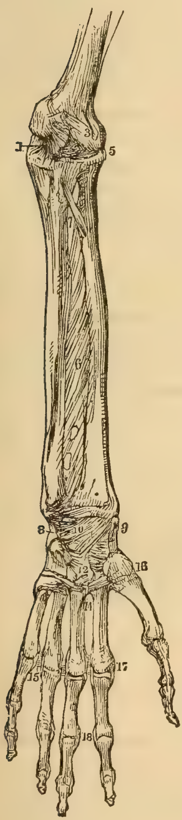
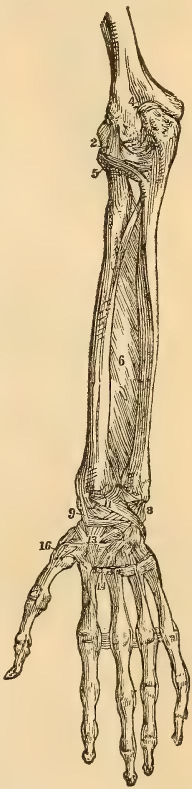


Fig. 45.



Describe the glenoid ligament. — It is a prismatic fibro-cartilaginous ring, giving depth to the glenoid cavity, which has a large synovial membrane.

What are the ligaments proper to the humerus?–The external and internal intermuscular.

Describe the external intermuscular ligament. — It arises from the external condyle, and is inserted into the middle of the outside of the bone.

What is the situation of the internal intermuscular ligament? — It arises from the internal condyle, and is inserted into the middle of the inside of the bone.

What are the ligaments (Figs. 44, 45, 46,) connecting the humerus to the radius and ulna? — The capsular, and the external and internal lateral.

What is the situation of the capsular ligament? — It arises round the trochlea of the humerus, and is inserted around the heads of the radius and ulna.

Describe the external lateral ligament.[2]—It arises from the external condyle of the humerus, and is inserted into the outside of the neck of the radius.

Where is the internal lateral ligament?[1]—It arises from the internal condyle, and is inserted into the inner side of the coronoid process of the ulna.

Fig. 46.

What are the ligaments connecting the radius and ulna?—The coronary, the oblique, the interosseous, and the sacciforme.

Describe the coronary ligament.[5]—It arises from the ulna, and surrounds the head of the radius.

Where is the oblique ligament?[7]—It arises from the base of the coronoid process of the ulna, and is inserted into the tubercle of the radius.

What is the situation of the interosseous ligament?[6]—It is attached to the acute edges of these bones, turned towards each other.

Describe the situation of the sacciforme ligament.—It unites in a distinct articulation the lower ends of the radius and ulna.

What are the ligaments from the radius and ulna to the carpus?—The capsular, the external, and the internal lateral; and between the end of the ulna and the os naviculare, a triangular, interarticular cartilage is placed.

Describe the capsular ligament.—It arises around the lower articular surfaces of the radius and ulna, and is inserted round the first three bones of the carpus.

Where is the external lateral ligament?[9]—It arises from the styloid process of the radius, and is inserted into the outside of the os scaphoides.

What is the situation of the internal lateral ligament?[8]—It arises from the styloid process of the ulna, and is inserted into the outside of the os cuneiforme and the os unciforme.

What are the ligaments of the carpus?—The capsular, the transverse, the posterior annular, and the vaginal.

Describe the capsular ligament.—It surrounds and connects all the carpal bones.

What is the situation of the transverse?—It passes from bone to bone, and ties them together.

Describe the posterior annular ligament.—It binds down the tendons of the extensor muscles to the back of the carpus.

Where is the anterior annular?—It arises from the os pisiforme, and os unciforme, and is inserted into the trapezium, and under it pass the flexor tendons.

Describe the vaginal ligaments.—They proceed from within the anterior annular, and sheath the flexor tendons.

What are the ligaments of the bases of the metacarpal bones?—The capsular, the lateral, the dorsal, and the palmar.

Describe the capsular ligaments.—They are derived from that of the carpus, which includes the bases of these bones.

Where are the lateral ligaments?—They are situated on each side of the articulations.

Describe the dorsal ligaments.—They are transverse ligaments, connecting the bases of these bones, on the back of the hands.

What is the situation of the palmar ligaments?—They connect the bases of the metacarpal bones in the palm.

What are the ligaments of the heads of the metacarpal bones?—The capsular, lateral, and transverse.

What are the ligaments of the joints of the fingers?—There are at each joint capsular and lateral ligaments.

LIGAMENTS OF THE LOWER EXTREMITY.

What are the ligaments connecting the os innominatum and the femur? (Figs. 47, 48.)—There are three, namely: a capsular, a round ligament or ligamentum teres, and cotyloid.

Fig. 47.

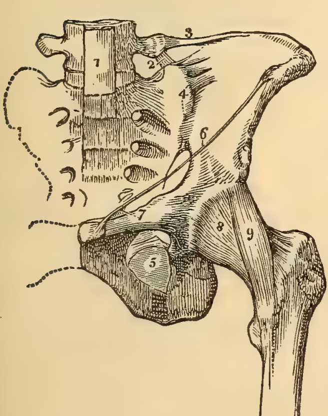
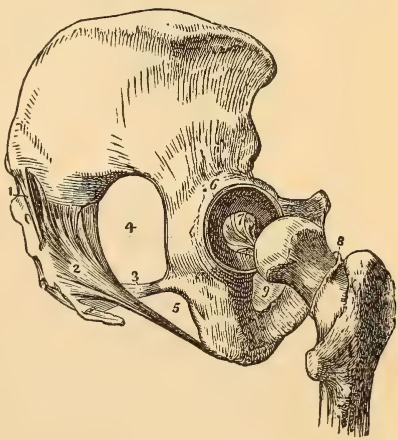


Fig. 48.



What is the situation of the capsular ligament?—It arises from the margin of the acetabulum, and is inserted around the root of the neck of the femur. A small fasciculus of fibres, called ileo-femoral,[9] strengthens the capsule.

Describe the round ligament.—It arises from the small depression

in the head of the femur, and is inserted into the middle of the acetabulum.[7]

Describe the cotyloid ligament.[6]—It tips the acetabulum, increasing its depth, and is fibro-cartilaginous in structure.

What are the ligaments which connect the femur with the tibia and fibula?—The capsular, popliteal, internal lateral, external lateral, anterior crucial, and posterior crucial.

Describe the capsular ligament.—It passes from the edges of the articular surface of the femur to those of the tibia, being attached also to the patella; called also involucrum generale.

Where is the popliteal ligament? (Figs. 49, 50.)—It arises from the external condyle of the femur, and, passing in the posterior part of the capsule, is expanded upon the internal side of the joint.

Fig. 49.

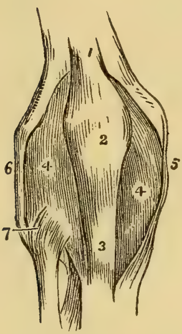
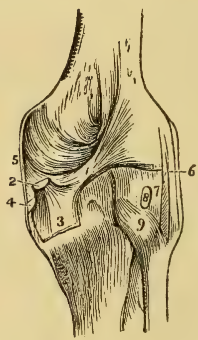


Fig. 50.



What is the situation of the external lateral ligament?[6]—It arises from the external condyle, and is inserted into the head of the fibula; it generally divides itself into two portions.

Describe the internal lateral ligament.[5]—It arises from the internal condyle, and is inserted into the inside of the head of the tibia.

Describe the semi-lunar cartilages.—They are two rings of fibro-cartilage, deepening the articulating surfaces of the tibia; the external[7] is smaller and rounder, the internal[6] is larger and semi-circular: a transverse band connects them behind.[4] (Fig. 51.)

Where is the posterior crucial?[3]—It arises from the inside of the notch, between the condyles of the femur, and is inserted into the posterior part of the rough ridge on the top of the tibia.

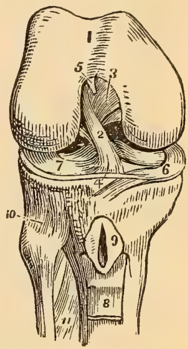
Describe the anterior crucial.[2]—It arises from the outside of the notch, between the condyles of the femur, and is inserted into the middle of the ridge on the top of the tibia.

What are the peculiarities of the synovial membrane of this joint?—It is the largest, with folds on the inner part, one of which is called

ligamentum mucosum,[5] passing from the condyloid notch to a piece of fat in front of the tibia.

What are the ligaments connecting the tibia and fibula?—The *anterior superior,*[7] extending obliquely from the head of the fibula to the internal tuberosity of the tibia, strengthened by the tendon of the *biceps flexor cruris;* the *posterior superior,*[9] situated like the former posteriorly; the *interosseus,*[11] placed between the two bones, with a small hole in the top for the anterior tibial artery; and the *transverse,* or *anterior inferior* and *posterior inferior.* (Figs. 49, 50.)

Fig. 51.



What are the ligaments of the patella?—The anterior ligament and the alar ligaments.

Describe the anterior ligament.[2 3]—It arises from the inferior point of the patella, and is inserted into the anterior tuberosity of the tibia.

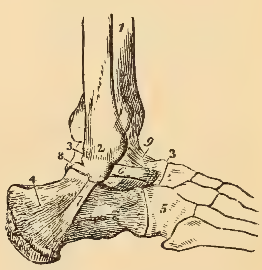
Where are the alar ligaments?—They proceed on each side from the inner side of the capsular, and are inserted into the sides of the patella.

Where are the transverse ligaments?—They connect the lower end of the fibula to that of the tibia, anteriorly and posteriorly.

What are the ligaments connecting the tibia and fibula to the tarsus? (Figs. 52, 53.)—The capsular, the deltoid, and the anterior, middle, and posterior ligaments of the fibula.

Fig. 52.

Fig. 53.



Describe the capsular ligament.—It surrounds the junction of the tibia and fibula with the astragalus.

Where is the deltoid ligament?[6]—It arises from the internal malleolus, and is inserted into the astragalus and naviculare.

What is the situation of the anterior ligament?[6]—It arises from the external malleolus, and is inserted into the outside of the astragalus.

Where is the middle ligament?[7]—It arises from the tip of the external malleolus, and is inserted into the outside of the os calcis.

Describe the posterior ligament.[8]— It arises from the back part of the external malleolus, and is inserted into the back part of the astragalus.

What are the ligaments of the tarsus? — The capsular, the transverse, the plantar, and a ligament at the internal side of the foot.

What is the office of the capsular ligament? — It includes all the tarsal and the heads of the metatarsal bones.

What is the use of the transverse ligaments? —They pass from one to another, and tie the individual bones together.

Where is the plantar ligament situated? — On the outer side of the sole of the foot.

Where is the internal ligament? — It passes from the lower part of the os calcis to the lower part of the os naviculare, supporting the astragalus.

What are the ligaments of the bases of the metatarsal bones?—The capsular, the lateral, the dorsal, and the plantar.

What are the capsular ligaments derived from? — From that of the tarsus, which includes the bases of these bones.

Where are the lateral ligaments situated? — On each side of the articulations.

Where are the dorsal ligaments? — They are transverse ligaments connecting these bones on the back of the foot.

What is the use of the plantar ligament? — It connects the metatarsal bones in the sole of the foot.

What are the ligaments of the head of the metatarsal bones? — The capsular, lateral, and transverse.

What are the ligaments of the joints of the toes? — The capsular and lateral.

How are the tendons of the foot and toes kept in their situations? — By ligamentous bands.

INTEGUMENTS OF THE BODY.

Of what do the integuments of the body consist? — Of the cellular and adipose substances and the derm.

What is the cellular substance? — A tissue of lamellæ and fine soft fibres, so interwoven as to produce cells, communicating with each other.

Where is this tissue found? — All over the body.

Are there bloodvessels in it? — Yes; but in a natural state very few of them convey red blood.

How have anatomists divided this tissue? — Into the external, or that next to the skin; and the internal, or that which dips in between vessels, muscles, &c.

What are its uses?—To separate organs, and by its elasticity allows parts to move smoothly, the one upon the other.

Is there not a peculiar serosity exhaled from the cellular tissue? — Yes.

ADIPOSE SUBSTANCE.

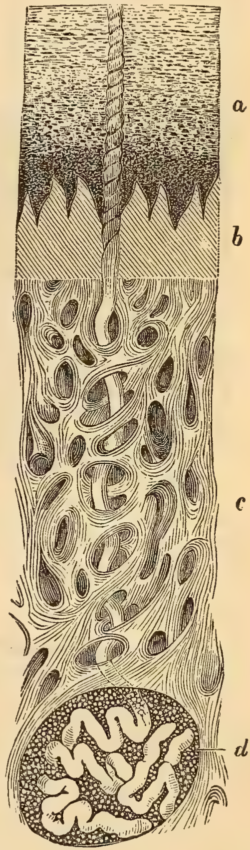
Where is this situated?[3] (Fig. 55.)—It is closely adherent to the skin, and in the condensed cellular substance next to the muscles and between the interstices of muscles, &c.

What parts are free from it? — The eyelids, interior of the cranium, the nose, ears, scrotum, penis, &c.

What is its structure? — It is a yellow oleaginous fluid, contained in distinct cells, having no communication with each other; and has three elements, stearine, margarine, and elaine.

What is its use ? — It is a reservoir of nourishment, and prevents pressure.

Fig. 54.



DERMA.

Describe the *derma*. (Fig. 54.)—It consists of the skin, its sebaceous glands, nails, hairs, and sweat-glands, which are considered appendages. It is the covering of the body, wrinkled by contraction of the muscles and joints; angular by the contractility of the skin, and spiral, where the skin comes in contact with the orifices going to the internal parts of the body; it gradually is converted into mucous membrane. Its surface changes by exposure and climate, and is connected to the adjacent parts by cellular tissue.

How is the skin divided? — Into *cutis vera* and the *cuticle*. The *cutis vera*[c] is the thicker and deeper, white and semi-transparent. Cellular and adipose substance is blended inferiorly with it, while externally we have the papillæ tactus.[b]

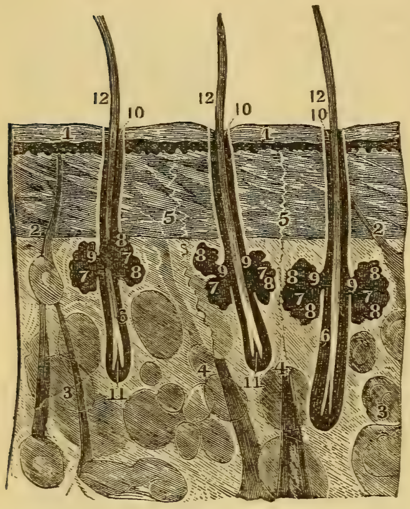
What are the papillæ of the skin? — They are numerous small eminences on its external surface, in which the capillary filaments of the cutaneous nerves terminate in radiated pencils; they are most prominent on the palms of the hands and soles of the feet, and on the fingers and toes.

In what form are they arranged? — In double rows, which are regularly placed as parallel, crooked, waving, or spiral lines; on the red part of the lips, they resemble fine hairs or villi.

Where is the sense of touch the most acute?—It is more particularly acute at the ends of the fingers.

Where are the sebaceous glands situated? (Fig. 55.)—They exist in the substance of the skin, and open on its surface.[7]

Fig. 55.



Where are they most conspicuous? — About the nose, cheeks, ears, arm-pits, groins, and genitals.

What is their use?—They secrete an unctuous fluid, which protects the skin from the effects of heat and friction.

What are the other openings in the cutis?—They are for the hairs,[6] and others very minute are called pores, which are the terminations of the exhalent vessels.

What is the cuticle?[1]—It is a delicate transparent membrane, covering the rete mucosum and cutis vera; it is thickest in the palms of the hands and soles of the feet; it dips in betwixt every minute fold of the cutis vera, and into every aperture on its surface.

What is its structure?—It does not appear to be organized, nor does it possess any sensibility.

What was formerly called *rete mucosum*?—The cuticle being in laminæ, the inferior of which was called by this name.

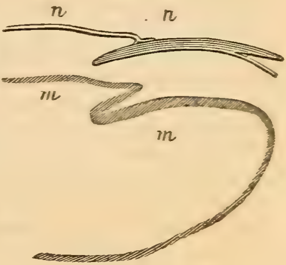
What are the *sweat glands*?—They are situated under the *cutis vera* of various sizes, and pink color in various parts of the body; the duct when magnified is seen to be very tortuous, with one end in the gland and the other opening on the skin. The duct has two portions, the dermic and epidermic, the former terminating in a funnel-shaped opening between the papillæ, the latter commences at the inner part of the cuticle, and assumes a spiral form.[4]

Of what are the nails (Fig. 56,) a continuation?—They are considered as a continuation of the cuticle; they appear as if implanted under a fold of the cutis vera, and adhere to a semilunar doubling of the cuticle.

What is their structure?—They resemble horn.

How are the nails formed? — They grow from the surface of the true skin, on which they lie, and their fibres shoot forward from their roots.

Fig. 56.



Where are the bulbs of the hair situated? — The hairs grow from roots, called bulbs, which are situated in the cutis vera; they are small pulpy bodies, invested by a membrane.[11] (Fig. 55.)

How do the hairs pass from the cutis? — They proceed betwixt the papillæ, and pierce the cuticle.

Describe the hair. — It is now called a rod, with a large number of scales overlapping each other.[12]

MYOLOGY.

What are muscles? — They are fleshy bodies, composed of bundles of parallel contractile fibres, with tendinous extremities, and each one consists of a head, belly, and termination.

How are muscles divided?—Into voluntary and involuntary.

What is their general appearance? — They are of a red color, and softer and thicker than the other parts.

What connects the fibres of muscles together? — Cellular tissue.

Have muscles many blood-vessels and nerves? — Yes.

Are tendons as well organized? — No.

What general names do muscles derive from the arrangement of their fibres?—If the fibres are longitudinal the muscle is termed simple; if they diverge from a tendinous centre they are termed radiated; and when they have a feathery arrangement upon their tendons they are called penniform; several of these united are called complex penniform.

Whence are the particular names of the muscles in general derived? — They generally derive their names either from their use as levators or depressors, from their form as trapezius, rhomboidius, &c., or from their situation as occipito frontalis, pectoralis, &c., or from their points of attachment as sterno-costalis, sterno-cleido-mastoidius, &c.

What are the tendons?—They are generally placed at the extremities of muscles, and are of a silvery hue, firm, compact, and incapable of contraction, or they cover the muscles, and connect the muscular fibres by membranous expansion.

What is the origin and insertion of a muscle?—The least movable point of attachment is called the origin, the most movable the insertion.

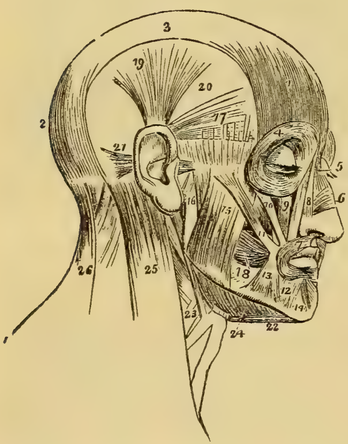
MUSCLES OF THE HEAD AND NECK.

What is the origin, insertion and use of the occipito frontalis? [1 2 3] (Fig. 57.) — Origin: two external thirds of superior transverse edge of occipital bone, external and posterior part of mastoid process. Insertion: integuments and muscles of eyebrows. Use: to pull the skin of the neck and head back and forward, and to throw the forehead into wrinkles, and elevate the supercilia.

Of the compressor naris? [6] — Origin: canine fossa in superior maxilla. Insertion: into its fellow of opposite side, on dorsum of nose, and lower part of the os nasi. Use: to compress and dilate the nostrils

Of the orbicularis palpebrarum? [4]—Origin: internal angular process, os frontis, and upper edge of tendo-occuli. Insertion: nasal process of superior maxilla and inferior edge of tendo-occuli. Use: by the contraction of the upper and lower halves of the muscle, it brings the eyelids together.

Fig. 57.



Of the corrugator supercilii? — Origin: internal angular process of os frontis. Insertion: middle of eyebrow. Use: to draw the eyebrow and skin of forehead in vertical wrinkles, and to draw them over the eye.

Of the levator labii superioris et alæ nasi? [8] — Origin: first, upper extremity of nasal process of superior maxilla; second, edge of orbit. Insertion: alæ nasi, upper lip, and orbicularis oris. Use: to draw the upper lip and ala nasi upwards.

Of the levator anguli oris? [9] — Origin: anterior part of the superior maxilla, between the foramen infra-orbitarum and first small grinder. Insertion: into corner of mouth. Use: to raise the angle of the mouth.

Of the zygomaticus minor? [10]— Origin: upper part of malar bone. Insertion: upper lip, near commissure. Use: as next muscle.

Of the zygomaticus major? [11]— Origin: lower part of malar bone, and angle of the mouth. Use: of two last muscles, to draw the corner of mouth towards the cheek bone.

Of the depressor labii superioris et alæ nasi? — Origin: alveoli of canine and incisor teeth. Insertion: integuments of upper lip, and cartilage of septum and ala nasi. Use: to depress the upper lip and ala nasi.

Of the depressor anguli oris? [13]— Origin: base of lower jaw on the

side of chin. Insertion: apex inserted into corner of the mouth. Use: to draw the corner of the mouth down.

Of the depressor labii inferioris?[12]—Origin: from base of lower jaw on side of chin. Insertion: into whole side of lower lip. Use: to draw the lip down.

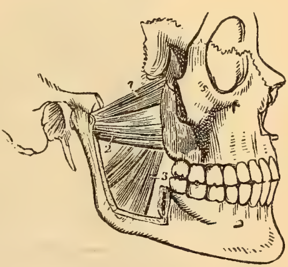
Of the levator menti et labia inferioris?[14]—Origin: alveoli of incisor teeth. Insertion: into lower lip. Use: elevates the lower lip.

Of the buccinator?[18]—Origin: from root of coronoid process of lower jaw, back part of upper jaw, and roots of alveolar processes of upper and lower jaw, as far as dentes bicuspides. Insertion: into corner of mouth, and contiguous parts of upper and lower lips. Use: to draw the corners of the mouth directly back.

Of the orbicularis oris?[7]—It surrounds the mouth. Use: to antagonise the other muscles of the mouth.

Of the masseter?[15,16]—Origin (anterior portion): superior maxilla at junction of malar bone and inferior edge of it. Insertion: outer surface of angle of lower jaw. Origin (posterior portion): edge of malar bone and zygoma. Insertion: external side of angle and ramus of lower jaw. Use: when both portions act, they close the jaws, when the external portion draws the jaw forward, the internal alone draws it back.

Fig. 58.



Of the pterygoideus internus?[3] (Fig. 58.)—Origin: inner side of external pterygoid plate, and pterygoid process of palate bone. Insertion: inner side of angle of jaw, and rough surface below. Use: to close the jaw.

Of the temporalis?—Origin: all beneath semi-circular ridge on parietal bone, temporal fossa and fascia. Insertion: coronoid process of inferior maxilla to last molar teeth. Use: to pull the lower jaw directly up.

Of the pterygoideus externus?[1,2]—Origin: outer side of external pterygoid plate, from great wing of sphenoid bone and back part of tuberosity of superior maxilla. Insertion: anterior and internal part of neck, of lower jaw and interarticular cartilage. Use: when the two muscles act together they draw the jaw forward, but if alternately, they produce a grinding motion.

What is the fascia superficialis colli?—A layer of compact cellular substance (and continuation of the fascia superficialis abdominis), between the skin of the neck and its superficial muscles.

What is the origin, insertion, and use of the platysma myoides?—Origin: cellular membrane covering upper part of deltoid and pectoral muscle, and also from the clavicle. Insertion: into the chin, fascia alongside of the lower jaw, and fascia along the parotid gland. Use: to elevate the skin of the neck.

8

Of the sterno-cleido mastoideus ?[11]— Origin: upper and anterior part of the first bone of the sternum[12] and sternal end of clavicle.[13] Insertion, upper part of mastoid process and external third of superior transverse ridge of occipital bone. Use: to draw the chin towards the sternum.

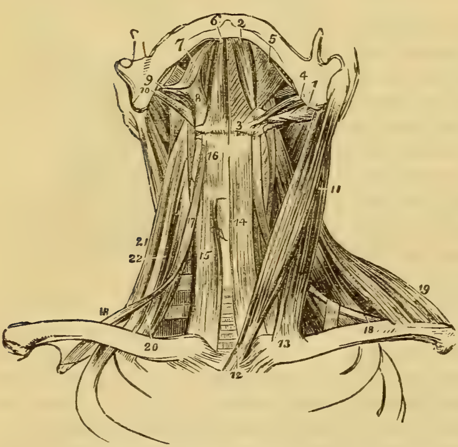
Where is the fascia profunda colli situated ? — When the origin of the sterno-cleido mastoideus is turned to one side, this fascia is seen beneath the superficial fascia, separated from it by cellular adipose matter. — [Horner's Anatomy.]

What is the origin, insertion, and use of the sterno-hyoideus ?[14]— Origin: posterior surface of the first bone of the sternum, cartilage of first rib, sternal end of clavicle and sterno-clavicular capsule. Insertion: lower border of the body of the os hyoides. Use: to draw the os hyoides towards the sternum.

Of the sterno-thyroideus ?[15]—Origin: posterior surface of sternum and cartilage of second rib. Insertion: obliquely into the side of thyroid cartilage. Use: to draw this cartilage to the sternum.

Of the thyro-hyoideus ?[16]— Origin: obliquely from side of thyroid cartilage. Insertion: into part of the base and nearly all the cornu of os hyoides. Use: to approximate the os hyoides and thyroid cartilage.

Fig. 59.



Of the omo-hyoideus ?[17 18]—Superior costa of scapula, from the ligament covering the notch on the scapula, sometimes from coracoid process, and the acromial end of clavicle. Insertion: into lower border of os hyoides at junction of body and cornu. Use: to draw the os hyoides down.

Of the digastricus ?[1 2] (Fig. 59.)—Origin: groove in temporal bone internal to mastoid process. Insertion: rough depression on inner side of base of jaw close to symphysis. Use: to draw the os hyoides up when its extremities are fixed, and to throw the head back and open the mouth, when the lower jaw is fixed upon a body of same height.

Of the stylo-hyoideus ?[3 4] — Origin: outer side of styloid process near its base. Insertion: cornu and body of the os hyoides and fascia connecting digastric tendon to this bone. Use: to draw os hyoides up and back.

Of the stylo-glossus ?[9] — Origin: styloid process near its point and stylo maxillary ligament. Insertion: side of tongue. Use: to draw the tongue back.

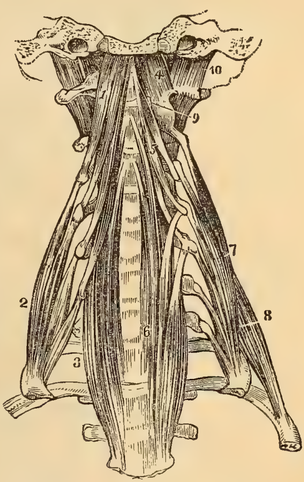
Of the stylo-pharyngeus ?[10] — Origin: back part of root of styloid process. Insertion: side of pharynx, cornu of os hyoides and thyroid cartilage. Use: to draw the larynx and pharynx up.

Of the mylo-hyoideus ?[5] — Origin: oblique line on inner surface of side of lower jaw. Insertion: base of os hyoides, and tendinous line between that bone and chin. Use: to draw the os hyoides up and project the tongue.

Of the genio-hyoideus ?[6] — Origin: inner side of chin above the digastric. Insertion: base of os hyoides. Use: to draw the os hyoides up and forward.

Of the longus colli ?[3,5,6] (Fig. 60.) — Origin: bodies of three superior dorsal and four inferior cervical vertebræ, intervertebral ligaments from the head of first rib and anterior tubercles of transverse processes of four last cervical vertebræ. Insertion: fore part of bodies of all the cervical vertebræ. Use: to bend the neck forward and to one side.

Fig. 60.



Of the rectus capitis anticus major ?[1] — Origin: anterior tubercles of transverse processes of four last cervical vertebræ. Insertion: into the cuneiform process of os occipitis. Use: to bend the head forward.

Of the rectus capitis anticus minor ?[4] — Origin: transverse process of atlas. Insertion: condyloid process of os occipitis. Use: to bend the head forward.

Of the rectus capitis literalis ?[10] — Origin: transverse process of atlas. Insertion: outside of condyle of occiput. Use: to pull the head to one side.

Of the scalenus anticus ?[2] — Origin: transverse processes of fourth, fifth, and sixth cervical vertebræ. Insertion: upper surface of first rib near its cartilage.

Of the scalenus medius ?[7] — Origin: from transverse processes of all the cervical vertebræ. Insertion: upper part of first rib, from middle to tubercle.

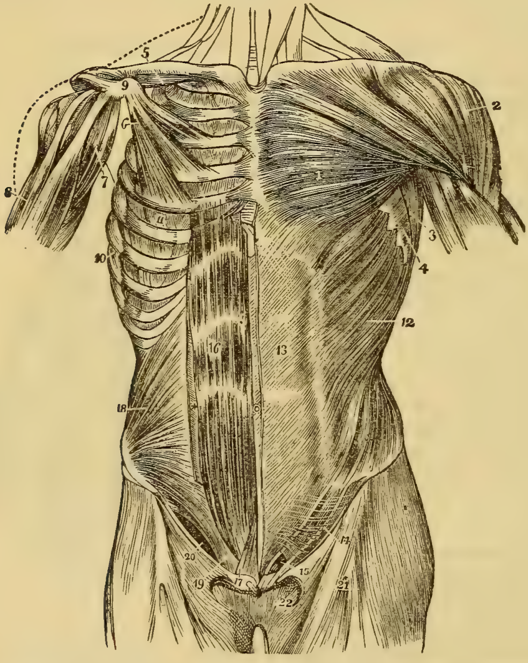
Of the scalenus posticus ?[8] — Origin: transverse processes of fifth and sixth cervical vertebræ. Insertion: upper edge of second rib, just beyond the tubercle. Use of these three muscles: to elevate the ribs and bend the neck to one side.

MUSCLES OF THE TRUNK.

ON FRONT OF THE THORAX.

What is the origin, insertion, and use of the pectoralis major? (Fig. 61.) — Origin: sternal half of the clavicle, anterior surface of sternum and cartilages of the third, fourth, fifth, and sixth true ribs, and from the aponeurosis common to it and external oblique. Insertion: anterior edge of bicipital groove and fascia of the arm. Use to draw the arm inwards and forwards, and to depress it when raised.

Fig. 61.



Of the pectoralis minor?[6]—Origin: external surface and upper edge of the third, fourth, and fifth ribs, and sometimes from the second. Insertion, inner and upper surface of the coracoid process. Use: to draw the scapula in and down.

Of the subclavius?[5] — Cartilage of the first rib. Insertion: external half of inferior surface of the clavicle. Use: draws the clavicle down.

Of the serratus magnus?[4] — Origin: eight or nine superior ribs. Insertion: base of the scapula. Use: to draw the scapula forward.

Of the intercostales? [11] — Origin: eleven external, from the inferior edge of each rib, commencing at the transverse processes of vertebræ. Insertion: external lip of superior edge of the ribs beneath the costal extremity of cartilage. Origin: eleven internal, from the sternum from inner lip and lower edge of each cartilage and rib to the angle. Insertion: inner lip of superior edge of cartilage, and rib beneath. Use: to draw the ribs together.

Of the triangularis sterni?—Origin: posterior surface and edge of lower part of sternum and xiphoid cartilage. Insertion: cartilages of fourth, fifth, and sixth ribs. Use: to depress the ribs, and diminish the cavity of the thorax.

MUSCLES AND FASCIÆ OF THE ABDOMEN.

What and where is the fascia superficialis abdominis situated? — Condensed cellular substance situated between the skin and superficial muscles of the abdomen, and extends from the front of the thighs to the thorax, and is traversed at its lower part by the *arteria ad cutem abdominis.*

What is the origin, insertion, and use of the obliquus externus? [12] (Fig. 61, *supra.*) — Origin: from the eight or nine inferior ribs, by muscular and fleshy digitations. Insertion: in the ensiform cartilage, linea alba pubis, Poupart's ligament, and two anterior thirds of the crest of the ilium. Its use is to bend the body, compress the abdomen, &c.

Of the obliquus internus? [18] — Origin: from the fascia lumborum, the crest of the ilium and external third of Poupart's ligament. Insertion: in the cartilages of the seven inferior ribs, ensiform cartilage, and whole length of the linea alba, and to the symphysis and upper edge of the pubis and linea innominata. Use: to bend the body.

Where is the cremaster muscle? — Origin: internal surface of external third of Poupart's ligament and lower edge of obliquus internus, and sometimes from the transversalis. Insertion: into the tunica vaginalis, testis, and scrotum. Use: to form an envelope for the cord.

What is the origin, insertion, and use of the transversalis? — Origin: from the fascia lumborum, crest of the ilium, iliac third of Poupart's ligament, seven lower ribs. Insertion: along with the obliquus internus, into the linea alba, upper edge of pubis and linea innominata. Use: to compress the abdomen.

What is the origin, insertion, and use of the rectus? [16] — Origin: upper and anterior part of the pubis. Insertion: into the ensiform cartilage and costo-xiphoid ligament, to cartilage of sixth, seventh, and fifth ribs, traversed by tendinous spaces called *lineæ transversæ.* Use: to depress the trunk, or to elevate the pubis and compress the abdomen.

What is the origin, insertion, and use of the pyramidalis ? — Origin: pubis. Insertion : into the linea alba,half way to the umbilicus. Use : to assist the rectus.

MUSCLES OF THE UPPER AND POSTERIOR PARIETES OF THE ABDOMEN.

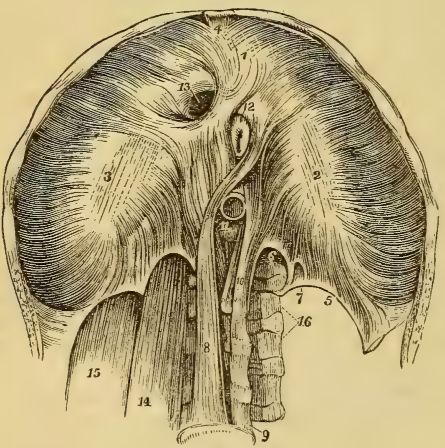
Where is the fascia transversalis abdominis situated ? — Immediately behind the transversalis muscle, between it and the peritoneum.

What renders this fascia interesting ? — The fact that the *internal abdominal ring* is falsely said to exist in it ; whereas no such ring exists in nature, but as the *fascia* becomes thin when it passes to cover the cord of the testicle, an opening is easily made by the knife.

Describe the diaphragm, and how is it divided. — It separates the thorax from the cavity of the abdomen, and is divided into the greater and lesser muscles.

What is the origin and insertion of the greater muscles ? [1 2 3] (Fig. 62.) — Origin : posterior surface of the xiphoid cartilage, internal surface of cartilages of last true and all the false ribs, from external ligamentum arcuatum,[5] and from the convex edge of the true ligament. Insertion : cordiform tendon.

Fig. 62.



Of the lesser muscle of the diaphragm ? [10] — Origin : right crus, from the fore part of the bodies of the four first lumbar vertebræ. Insertion : posterior border of the cordiform tendon.

What are the openings in the diaphragm, and their use ? — One in the tendinous centre,[13] *foramen quadratum*, transmitting the *vena cava ascendens*, an elliptical opening,[12] *foramen œsophageum*, for the œsophagus and par vageum nerves, and the *hiatus aorticus*,[11] through which passes the aorta, the thoracic duct, the azygos vein, and splanchnic nerve. The diaphragm, as a whole, diminishes the abdominal cavity, and vice versa, as it is raised.

What is the origin, insertion, and use of the quadratus lumborum ? [15] Origin : posterior fourth of spine of the ilium and ilio-lumbar liga-

ment. Insertion: into the extremity of transverse processes of the four first lumbar vertebræ and last dorsal, and also from the posterior half of last rib. Use: to bend the trunk to one side, or forward.

Of the psoas muscle?[14]—Origin: from the sides of the bodies of the lumbar and lower dorsal vertebræ, and from their transverse processes. Insertion: into the cavity of the pelvis, back part of the lesser trochanter of *os femons* and ridge below it. Use: to bend the loins.

Of the iliacus internus?—Origin: transverse process of the last lumbar vertebra, from three anterior fourths of crest of ilium, anterior spinous processes, brim of acetabulum, iliac fossa and fascia. Insertion: with the psoas muscles into the anterior and inner surface of the femur, below lesser trochanter. Use: to bend the thigh.

What is the fascia iliaca?—The tendinous membrane lying upon the iliacus internus, and the psoas muscles, and externally connected with the crista of the ilium, with the brim of the pelvis sinking into the cavity of the pelvis; it is continuous with the aponeurosis pelvica, and is inserted into the edge of the crural arch, and becomes continuous with fascia transversalis abdominis.—[Horner's Anatomy.]

MUSCLES OF THE POSTERIOR PART OF THE TRUNK.

What is the origin, insertion, and use of the trapezius?[1] (Fig. 63.) —Origin: internal third of superior transverse ridge of the occipital bone, ligamentum nuchæ, spinous process of last cervical and the dorsal vertebræ. Insertion: external third of clavicle and acromion process, and upper edge and spine of scapula. Use: to pull the scapula upward and backward, or backward and downward.

Of the latissimus dorsi?[4]—Origin: six inferior dorsal spines, by the fascia lumborum, back of sacrum, posterior third of the crest of the ilium, and three or four last ribs. Insertion: inner or posterior edge of the bicipital groove. Use: to move the arm backward and downward, and to rotate the humerus.

Of the serratus inferior posticus?[16]—Origin: last two dorsal and upper two lumbar spines. Insertion: lower edge of four inferior ribs, anterior to angles. Use: to draw the ribs down and antagonise the diaphragm and the serratus superior posticus.

Of the rhomboideus minor?[11]—Origin: from lower part of ligamentum nuchæ and last cervical spinous process. Insertion: base of capula opposite to and above the spine.

Of the rhomboideus major?[12]—Origin: from four or five superior dorsal spines. Insertion: base of scapula, from the spine to inferior angle. Use of both of these: to draw the scapula up and back.

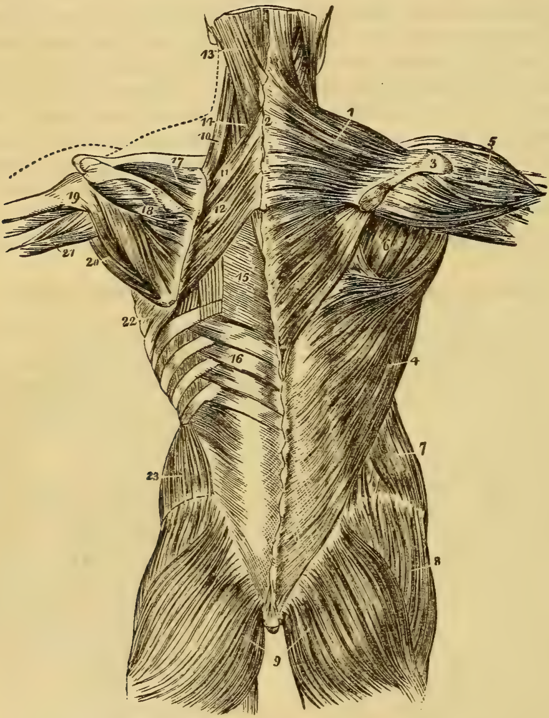
Of the serratus superior posticus?—Origin: ligamentum nuchæ, and from two or three dorsal spines. Insertion: second, third, and fourth ribs, external to angles. Use: to draw the ribs up.

Of the levator anguli scapulæ?[10]—Origin: posterior tubercles and transverse processes of four or five superior cervical vertebræ.

Insertion: base of scapula, between spine and superior angle. Use: draws the scapula up.

Of the splenius capitis and colli?[13 14] — Origin: from the spines of the five inferior cervical and four superior dorsal. Insertion: into the mastoid process and part of os occipitis, and from the transverse

Fig. 63.



processes of two superior cervical vertebræ. Use: to draw the head and neck back.

Of the sacro-lumbalis[2] (Fig. 64,) and longissimus dorsi?[3] — Origin: they have a common origin from the back of the pelvis, lumbar vertebræ, and extend to the top of the thorax. Insertion: into all the ribs near their angles, into all the dorsal vertebræ, and into the ribs between the angles and tubercles. Use: to keep the spine erect and draw down the ribs.

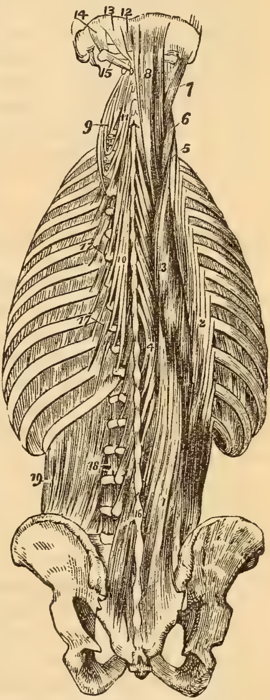
Of the spinalis dorsi?[4] — Origin: two superior lumbar and three

inferior dorsal spines. Insertion: nine superior dorsal spines. Use: to keep the spine erect.

Of the musculi accessorii? — Origin: superior edge of each rib. Insertion: tendons of sacro-lumbalis. Use: to assist the sacro-lumbalis, &c.

Of the cervicalis ascendens?[5] — Origin: by four or five tendons, from as many superior ribs between their tubercles and angles. Insertion: transverse processes of the fourth, fifth, and sixth cervical vertebræ. Use: to draw the neck back.

Fig. 64.



Of the transversalis cervicis?[9] — Origin: from the transverse processes of five or six superior dorsal vertebræ. Insertion: into transverse processes of the three or four inferior cervical vertebræ. Use: to draw the head back.

Of the trachelo mastoideus?[7]—Origin: from transverse processes of three or four superior dorsal vertebræ, and as many inferior cervical. Insertion: inner and back part of mastoid process. Use: to draw the head back.

Of the complexus?[8] — Origin: transverse and oblique processes of three or four inferior cervical, and five or six superior dorsal vertebræ. Insertion: occipital bone between the two transverse ridges close to its fellow. Use: to draw the head back.

Of the semi-spinalis colli?[11] — Origin: from the transverse processes of the six upper vertebræ of the back. Insertion: into the sides of the spinous processes of the five middle cervical vertebræ. Use: to extend the neck obliquely.

Of the semi-spinalis dorsi?[10] —Origin: by five or six tendons from the transverse processes of the dorsal vertebræ, from five to eleven. Insertion: by five or six tendons, into the extremity of the two inferior cervical and three or four superior dorsal vertebræ. Use: to draw the spine obliquely back.

Of the multifidus spinæ?[16]— Origin: the first arises from the spine of the dentatus, and is inserted into the transverse process of the third, and so on to the last, which arises from the spine of the last lumbar vertebræ, and is inserted into the false transverse process of the sacrum. Use: to twist the spine back and keep it erect.

Of the rectus capitis posticus major?[13]—Origin: spinous process of

the second vertebræ. Insertion: inferior transverse occipital ridge. Use: to turn the head and draw it back.

Of the rectus capitis posticus minor?[12] — Origin: posterior part of atlas. Insertion: occipital bone behind the foramen magnum. Use: to draw the head back.

Of the obliquus capitis superior?[14] — Origin: upper part of transverse process of atlas. Insertion: occipital bone between its transverse ridges just behind the mastoid process. Use: to draw the head back

Of the obliquus capitis inferior?[15] — Origin: spinous process of se cond vertebra. Insertion: extremity of transverse process of atlas. Use: to rotate the first vertebra in the second.

Of the interspinalis, intertransversarii and levatores costarum? — They are described by name. The use of the first, to draw the spinous processes together, and keep the spine erect. The second, draw the transverse processes together and bend the spine laterally; the third, elevate the ribs.

FASCIA AND MUSCLES OF THE UPPER EXTREMITY.

Have the upper extremities a fascia, and what are its uses? — They have one called the fascia brachialis, extending from the shoulder to the hand, sending down expansions to the bones, and also affording in some instances partial attachment to muscles, &c.

What is the origin, insertion, and use of the deltoides?[5] (Fig. 63, *supra.*) — Origin: lower edge of spine of scapula, anterior edge of acromion, and external third of clavicle. Insertion: rough surface on outer side of humerus. Use: to raise the os humeri.

Of the supra-spinatus?[17] — Origin: all above the spine of scapula and fascia covering this muscle. Insertion: upper and fore part of great tuberosity of humerus. Use: to raise the arm and turn it out.

Of the infra-spinatus?[18] — Origin: inferior surface of spine of scapula and dorsum, and from aponeurosis of this muscle. Use: to roll the os humeri outward and back.

Of the teres minor?[19] — Origin: from the fossa and margin of inferior costa, from the space from the cervix of the bone to within an inch of its angle. Insertion: inferior depression in great tuberosity of humerus. Use: to draw the os humeri down and back, and rotate it outwards.

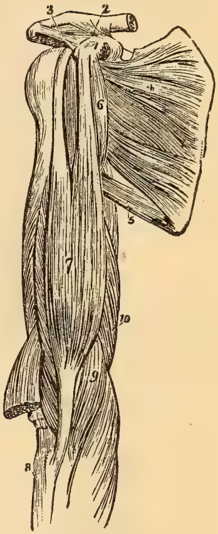
Of the teres major?[20] — Origin: rough, flat surface on inferior angle of scapula, below infra-spinatus. Insertion: inner edge of bicipital groove. Use: to roll the humerus inwards, and draw it back and down.

Of the subscapularis?[4] (Fig. 65.) — Origin: all the surface and circumference of sub-scapular fossa. Insertion: small tubercle of humerus. Use: to roll the bone in, and draw it down.

Of the biceps?[7] — Origin: short head, from coracoid process; long

head, upper part of glenoid cavity of scapula. Insertion: back part of tubercle of radius. Use: to flex the fore-arm.

Fig. 65.



Of the coraco-brachialis?[6]—Origin: point of coracoid process and tendon of short head of biceps. Insertion: internal side of humerus, about the middle, and ridge leading to internal condyle. Use: to draw the arm up and forward.

Of the brachialis internus?[9]—Origin: centre of humerus, by two fleshy slips on either side of insertion of deltoid and from forepart of bone to condyle. Insertion: coronoid process of ulna, and rough surface beneath that process. Use: to flex the forearm and strengthen the elbow joint.

Of the triceps extensor cubiti?[10]—Origin: long head, from lower part of neck of scapula and anterior portion of inferior costa; second head, below insertion of teres minor, ridge on outer side of humerus and behind the ridge, intermuscular ligament and external condyle; third head, below insertion, of teres major ridge to internal condyle, and internal intermuscular ligament. Insertion: olecranon process of ulna. Use: to extend the forearm.

Of the anconeus?—Origin: external condyle, posterior and inferior part of the humerus. Insertion: external surface of olecranon, and superior fifth of posterior surface of ulna. Use: to extend the forearm.

Of the pronator radii teres?[4] (Figs. 66, 67.)—Origin: anterior part of internal condyle, fascia of forearm, and intermuscular septa and coronoid process of ulna. Insertion: outer and back part of radius about the centre. Use: to roll the hand in.

Of the flexor carpi-radialis?[5]—Origin: inner condyle and intermuscular septa. Insertion: base of metacarpal bone of index finger. Use: to bend the hand and draw it to the radius.

Of the palmaris longus?[6]—Origin: inner condyle and fascia of forearm. Insertion: near root of thumb, in the annular ligament and palmar aponeurosis. Use: to bend the hand, and to make tense the palmar aponeurosis.

Of the flexor carpi-ulnaris?[8]—Origin: inner condyle, inner side of olecranon process, inner edge of ulna and fascia of forearm. Insertion: pisiforme bone, and base of fifth metacarpal bone. Use: to bend the hand, and draw it to the ulna.

Of the flexor digitorum sublimus perforatus?[7]—Origin: inner condyle and lateral ligament, condyloid process, and radius below its tu-

bercle. Insertion: anterior part of second phalanges. Use: to bend the second phalanges on the first, and to clench the hand and bend it on the forearm.

Fig. 66.

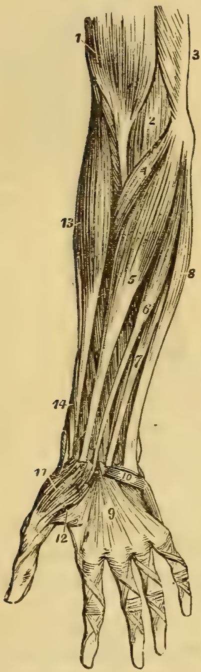


Fig. 67.

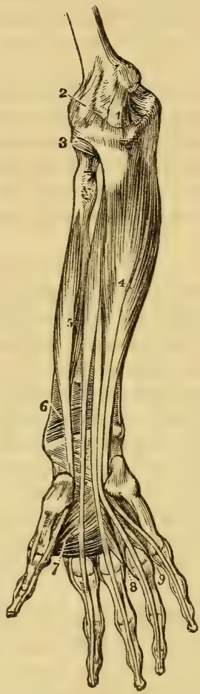
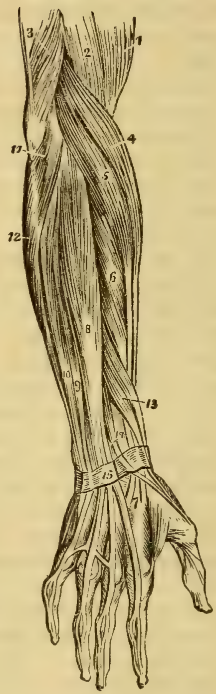


Fig. 68.



Of the flexor digitorum profundus perforans?[4] (Fig. 67.) Origin: three superior portions of anterior surface of ulna, internal half of interosseous ligament, and from radius below tubercle. Insertion: last phalanx of each finger. Use: to bend the last phalanges of the fingers, and may flex the arm and hand like the preceding muscle.

Of the flexor longus pollicis?[5]—Origin: fore part of radius below tubercle, within two inches of carpus, and from coronoid process. Insertion: last phalanx of thumb. Use: to bend the last joint of thumb.

Of the pronator quadratus?[6]—Origin: inferior fifth of anterior surface of ulna. Insertion: anterior part of inferior fourth of radius. Use: to rotate the radius inwards.

Of the supinator radii longus?[4] (Fig. 68.)—Origin: external ridge of humerus, from below deltoid to within two inches of outer condyle, and from intermuscular ligament. Insertion: rough surface on outside of radius, near styloid process. Use: to roll the radius outwards.

Of the extensor carpi radialis longior?[5]—Origin: ridge of humerus between supinator longus and external condyle. Insertion: back part of carpal end of metacarpal bone of index finger. Use: to extend the hand.

Of the extensor carpi radialis brevior?[6]—Origin: inferior and posterior part of external condyle and lateral ligament. Insertion: carpal extremity of the third metacarpal bone. Use: to extend the hand.

Of the extensor carpi ulnaris?[10]—Origin: external condyle, fascia, and intermuscular septa, and from the ulna. Insertion: carpal end of the fifth metacarpal bone. Use: to extend the hand.

Of the extensor digitorum communis?[8]—Origin: external condyle, fascia, and intermuscular process, and from the ulna. Insertion: phalanges of four fingers. Use: to extend all the joints of the fingers.

Of the supinator radii brevis?—Origin: external condyle, lateral and coronary ligaments, ridge on outer side of ulna. Insertion: upper third of external and anterior surface of this bone, above its tubercle to insertion of pronator teres. Use: to rotate the radius out.

Of the extensor ossis metacarpi pollicis manus?—Origin: middle of posterior part of ulna below anconeus, interosseous ligament, posterior surface of radius below supinator radii brevis. Insertion: os trapezium and metacarpal bone of thumb. Use: to extend the metacarpal bone of thumb.

Of the extensor minor pollicis manus?[13]—Origin: back of ulna below its middle, from interosseous ligament and radius. Insertion: posterior part of first phalanx, and often of second. Use: to extend the first phalanx.

Of the extensor major pollicis manus?[14]—Origin: posterior surface of ulna, above its centre and interosseous membrane. Insertion: posterior part of last phalanx. Use: to extend the phalanx.

Of the indicator?—Origin: middle of posterior surface of ulna, and interosseous membrane. Insertion: second and third phalanges.

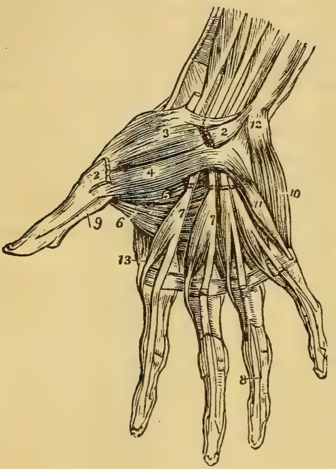
Of the palmaris brevis?—Origin: annular ligament and palmar fascia. Insertion: integuments on inner side of palm of hand. Use: to contract the skin of the hand.

Of the lumbricales?[7] (Fig. 69.)—Origin: outer side of the tendons of the flexor profundus, near the carpus and a little beyond the annular ligament. Insertion: middle of first phalanx into the tendinous expansion covering the back of each finger. Use: to bend the first phalanges.

Of the abductor pollicis manus?[2]—Origin: anterior part of annular ligament, os naviculare and trapezius. Insertion: outside of base of first phalanx and into both phalanges. Use: to draw the thumb from the forefingers.

Of the opponens pollicis?[3]—Origin: annular ligament, and os trapezium. Insertion: anterior extremity of metacarpal bone of thumb. Use: to draw the metacarpal bone inwards.

Fig. 69.



Of the flexor brevis pollicis manus?[4 5]—Origin: external head from inside of annular ligament, and the trapezium and scaphoid bones. Insertion: external sesamoid bone and base of first phalanx of thumb. Second head: Origin: from os magnum and base of metacarpal bone of middle finger. Insertion: internal sesamoid bone and base of first phalanx. Use: to bend the first phalanx of the thumb.

Of the adductor pollicis manus?[6]—Origin: three-fourths of anterior surface of third metacarpal bone. Insertion: inner side of root of first phalanx of thumb. Use: to pull the thumb towards the fingers.

Of the abductor indicis manus?—Origin: metacarpal bones of forefinger and half of that of the thumb. Insertion: outer side of base of first phalanx. Use: to draw the forefinger from the others.

Of the abductor minimi digiti manus?[10]—Origin: annular ligament and os pisiforme. Insertion: ulna side of first phalanx. Use: to draw the little finger from the rest.

Of the flexor brevis minimi digiti manus?[11]—Origin: annular ligament and os unciforme. Insertion: base of first phalanx of little finger. Use: to bend the little finger.

Of the abductor metacarpi minimi digiti?—Origin: internal to the last and overlapped by it. Insertion: the whole metacarpal bone of this finger. Use: to bring the metacarpal bone of little finger to wrist.

Of the prior indicis?—Origin, from base and side of the first digital metacarpal bone. Insertion, into radial side of first phalanx. Use, to draw the forefinger to the thumb.

Of the posterior indicis?—Origin, from base and ulnar side of the first digital metacarpal bone. Insertion, in ulnar side of first phalanx of forefinger. Use, to draw the forefinger to the others.

Of the prior annularis?—From the base and radial side of metacarpal bone of third finger. Insertion, radial side of first phalanx of third finger. Use, to draw that finger towards the thumb.

Of the interosseous digiti auricularis?—Origin, radial side and

base of metacarpal bone of little finger. Insertion: into radial side of first phalanx of same finger. Use: to draw the little finger to the others.

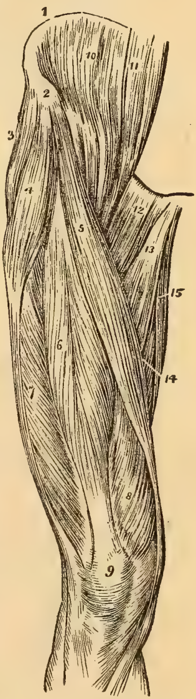
Of the prior medii? — Origin: opposite root and sides of the metacarpal bones of the fore and middle fingers. Insertion: into radial side of first phalanx of middle finger. Use: to draw the middle finger to the thumb.

Of the posterior medii? — Origin: from the opposite sides and roots of the metacarpal bones of middle and ring fingers. Insertion: into ulnar side of first phalanx of middle finger. Use: to draw the middle finger towards the little one.

Of the posterior annularis? — Origin: from opposite sides and roots of the metacarpal bones of ring and little fingers. Insertion: into ulnar side of first phalanx of ring finger. Use: to draw the ring to the little finger.

FASCIA AND MUSCLES OF THE INFERIOR EXTREMITY.

Fig. 70.



What are the various divisions of the fascia of the lower extremities? — That covering the thigh or the fascia lata femoris, divided into iliac and pubic, an involucrum at the knee, an annular ligament at the ankle, and ligamentum laciniatum at the os calcis. That covering the leg or fascia cruralis. The aponeurosis dorsalis on the top of the foot, and the aponeurosis plantaris on the sole of the foot.

What is the origin, insertion, and use of the tensor vaginæ femoris?[4] (Fig. 70.) — Origin: anterior superior spinous process of ilium. Insertion: duplicature of fascia lata on outside of thigh. Use: to rotate the foot inward, and make tense the fascia.

Of the sartorius?[5] — Origin: anterior superior spinous process of ilium. Insertion: upper end of tibia. Use: to bend the leg and draw it obliquely in.

Of the rectus femoris?[6] — Origin: from anterior inferior spinous process of ilium and from acetabulum. Insertion: upper edge of patella. Use: to extend the leg.

Of the vastus externus?[7] — Origin: just below the trochanter major, outer edge of linea aspera, and upper half of line running to external condyle. Insertion: external edge of tendon of rectus, and external and upper part of patella. Use: to extend the leg.

Of the vastus internus?[8] — Origin: just on a level with trochanter minor, inner edge of linea aspera, and from the line leading to internal condyle. Insertion:

inner edge of tendon of rectus, and edge of patella. Use: to extend the leg.

Of the cruræus? — Origin: anterior and external part of femur, as far as linea aspera. Insertion: posterior face of tendon of rectus, and upper surface of patella. Use: to extend the leg.

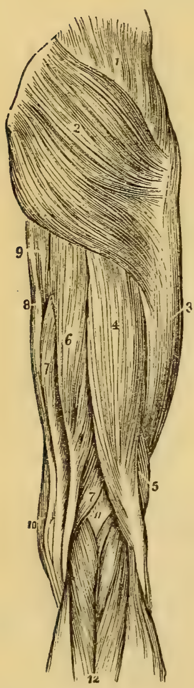
Of the gracilis? [15] — Origin: lower half of symphysis and inner edge of descending ramus of pubis. Insertion: superior part of internal surface of tibia. Use: to flex the leg.

Of the pectineus? [12]— Origin: linea innominata, or the horizontal portion of pubis. Insertion: into linea aspera below the trochanter minor. Use: to draw the thigh inward and forwards.

Of the adductor longus? [13] — Origin: anterior surface of pubis between spine and symphysis. Insertion: middle third of linea aspera.

Of the adductor brevis? — Origin: anterior inferior surface of pubis, between symphysis and thyroid foramen. Insertion: superior third of internal root of linea aspera, below lesser trochanter.

Fig. 71.



Of the adductor magnus? [14]—Origin: anterior surface of descending ramus of pubis, ramus of ischium, and external border of tuberosity of ischium. Insertion: rough ridge, leading from great trochanter to linea aspera, the linea aspera and internal condyle of femur. Use: the combined use of these three muscles is to draw the thigh inwards, and are sometimes called the triceps adductor femoris.

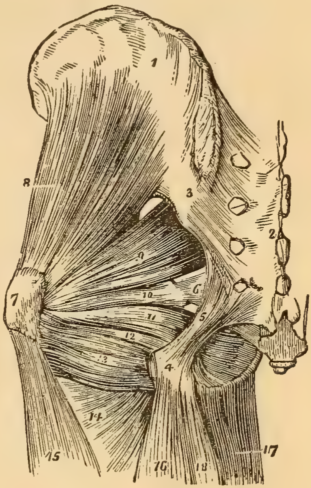
Of the glutæus maximus? [2] (Fig. 71.)—Origin: posterior third of spine of ilium, side of sacrum below it, side of os coccygis, and large sacro-sciatic ligament. Insertion: rough edge leading from trochanter to linea aspera, upper third of linea aspera, and fascia lata. Use: to draw the thigh back and keep the trunk erect.

Of the glutæus medius? [1] — Origin: all the spine of ilium except posterior part, and from dorsum between spine and semicircular ridge, extending from anterior superior spine to sciatic notch, and from lunated edge of the os ilium, and inner part of fascia femoris which covers it. Insertion: upper and outer part of great trochanter. Use: to draw the thigh back and out.

Of the glutæus minimus? [8] (Fig. 72.)—Origin: inferior semicircular ridge on the dorsum of ilium, rough surface between it and edge of acetabulum. Insertion: upper and anterior part of great trochanter. Use: to abduct the thigh and rotate the limb inwards.

Of the pyriformis? [9]—Origin: anterior surface of second, third, and fourth divisions of sacrum, and from the great sciatic ligament and upper and back part of ilium. Insertion: upper part of digital fossa at root of trochanter. Use: to rotate the limb in.

Fig. 72.



Of the gemini? [10] [12]—Origin: the upper one from the posterior part of the root of the spine of ischium. The lower one from the upper back part of tuberosity. Insertion: together at posterior part of the root of trochanter major. Use: to rotate the limb inwards.

Of the obturator internus? [11]—Origin: fleshy from the pelvic margin of foramen thyroideum, from the membrane covering the base, except where the vessels pass out, the plane of ischium, below linea innominata. Insertion: digital fossa of great trochanter. Use: to rotate the limb outwards.

Of the quadratus femoris? [13]—Origin: external surface of tuber ischii. Insertion: interior and superior part of great trochanter and the line between the two trochanters. Use: to rotate the limb outward.

Of the obturator externus?—Origin: inferior surface of obturator ligament. Insertion: lower part of digital fossa. Use: to rotate the thigh out.

Of the biceps flexor cruris? [16]—Origin: long head, outer and back part of tuber ischii; short head, linea aspera below insertion of glutæus maximus, within two inches of external condyle. Insertion: head of fibula. Use: to flex the leg on the thigh.

Of the semi-tendinosus? [18]—Origin: great tuberosity of ischium within the biceps, and continues within its tendon three inches. Insertion: anterior angle of tibia below the tubercle. Use: to flex the leg on the thigh.

Of the semi-membranosus?—Origin, upper and outer part of tuber ischii there divides and is —— Inserted: the first process into external condyle of femur; second process into posterior part of heads of tibia and fibula, third into the head of tibia. Use: to flex the leg on the thigh.

Of the tibialis anticus? [3] (Fig. 73.)—Origin: head of tibia, outer surface, spine, interosseous ligament, and from internal face of fascia of the leg. Insertion: inner side of great cuneiform bone, and base of first metatarsal. Use: to bend the foot and present the sole obliquely in.

Of the extensor longus digitorum pedis?[4] — Origin: external part of head of tibia, and fibula, three-fourths of this bone, part of interosseus ligament, fascia of leg, and intermuscular septa. Insertion: last phalanx of each of four external toes. Use: to extend the toes, and bend the foot.

Of the peroneus tertius?[6] — Origin: anterior angle of fibula at the lower half. Insertion: base of metatarsal bone of little toe. Use: to bend the foot.

Of the extensor propius pollicis pedis?[5] — Origin: inner edge of

Fig. 73.

Fig. 74.

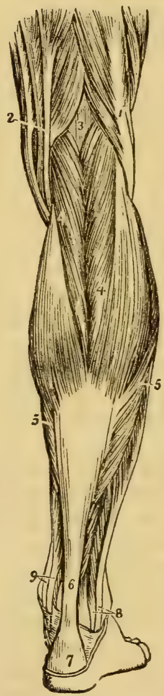
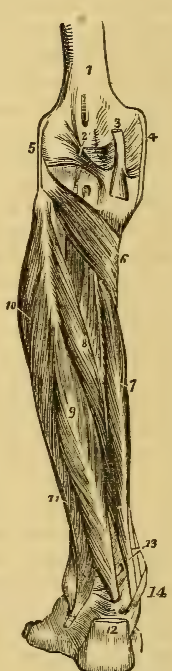


Fig. 75.



middle third of fibula, interosseus ligament, and lower part of tibia. Insertion: into the base of the first and second phalanx of great toe. Use: to extend the great toe.

Of the peronæus longus?[7] — Origin: around the head of the fibula, adjacent surface of tibia, upper half of external angle of fibula, fascia, and intermuscular septa. Insertion: outer side of metatarsal bone of great toe, and sesamoid bone, internal cuneiform and base of

second metatarsal bone. Use: to extend the foot, and to incline the sole obliquely inwards.

Of the peronæus brevis?[8]—Origin: outer and back part of lower half of fibula and intermuscular septa. Insertion: base of metatarsal bone of little toe, and into the os cuboides. Use: to extend the foot and present the sole obliquely down.

Triceps Suræ—Of the gastrocnemius?[4] (Figs. 74, 75.)—Origin: internal head from upper and back part of internal condyle of femur and oblique ridge above it, the external from above the external condyle. Insertion: lower and back part of os calcis.

Of the soleus?[5 5]—Origin: external head from back part of head and superior third of fibula; internal head from middle third of tibia, and unites with the above muscle to form the tendo-Achillis. Insertion: lower and back part of os calcis. Use: this muscle with the preceding extends the foot, and is all important in walking.

Of the plantaris?—Origin: back part of femur above external condyle and posterior ligament of knee. Insertion: posterior part of os calcis anterior to tendo-Achillis. Use: to extend the foot.

Of the popliteus?[6]—Origin: depression on outer condyle. Insertion: triangular surface on superior fifth of posterior surface of tibia.

Of the flexor longus digitorum pedis perforans?[7]—Origin: posterior flat surface of tibia within three inches of ankle, from fascia and intermuscular septa. Insertion: last phalanx of four lesser toes. Use: to flex the small toes and extend the foot.

Of the flexor longus pollicis pedis?[9]—Origin: inferior two-thirds of fibula. Insertion: last phalanx of great toe. Use: to bend the great toe.

Of the tibialis posticus?[8]—Origin: posterior and internal part of fibula, upper part of tibia and interosseous ligament. Insertion: tuberosity or inferior internal part of os naviculare, internal cuneiform bone, cuboid, and second and third metatarsal. Use: to extend the foot and present the sole obliquely inwards.

Of the extensor brevis digitorum pedis?[11] (Fig. 73, *supra.*)—Origin: upper and anterior part of os calcis, cuboid bone, astragalus and annular ligament. Insertion: internal tendon into base of first phalanx of great toe and the three others, and joins the outer edge of corresponding tendon of extensor longus, and assists in forming the aponeurosis to each toe. Use: to extend the toes.

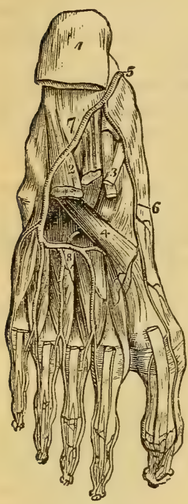
Of the flexor brevis digitorum pedis?[5] (Fig. 76.)—Origin: inferior internal part of os calcis, annular ligament, plantar aponeurosis, and intermuscular septa. Insertion: second phalanx of four outer toes. Use: to bend the second joint of toes.

Of the flexor accessorius?—Origin: inferior and internal part of os calcis. Insertion: upper and outer part of tendon of flexor digitorum longus. Use: to assist in flexing toes.

Of the lumbricales pedis?[7]—Origin: tendons of flexor longus.

Insertion: internal side of first phalanx of four lesser toes. Use: to increase flexion of toes and draw them in.

Fig. 76.



Of the abductor pollicis pedis?[3] — Origin: lower and inner part of os calcis, internal annular ligament, plantar aponeurosis, and internal muscular septa. Insertion: internal sesamoid bone, internal side of first phalanx of great toe. Use: to draw the great toe from the rest.

Of the flexor brevis pollicis pedis?—Origin: lower and anterior part of os calcis, external cuneiform bone. Insertion: sesamoid bones beneath phalanx of great toe. Use: to flex the great toe.

Of the adductor pollicis pedis?—Origin: calcaneo-cuboid ligament, base of second and third metacarpal bones. Insertion: external sesamoid bone within the last. Use: to draw the great toe towards the others.

Of the abductor minimi digiti pedis[4] — Origin: outer tuberosity of os calcis, exterior part of base of metatarsal bone of little toe. Insertion: into exterior part of base of metatarsal bone of little toe. Use: to draw the little toe from the others.

Of the transversalis pedis? — Origin: anterior extremities of four external metatarsal bones. Insertion: external sesamoid bone of great toe. Use: to approximate the heads of metatarsal bones.

Of the abductor indicis pedis? — Origin: from double head at opposite surfaces of roots of metatarsal bones of great toe and first small toe. Insertion: inside of root of first joint of first small toe. Use: pulls it in.

Of the adductor indicis pedis? — Origin: from opposite roots of metatarsal bones of first and second small toes. Insertion: into outside of phalanx of same toe by tendon. Use: to draw the toe outwards.

Of the adductor medii digiti? — Origin: opposite surfaces of roots of second and third metatarsal bones of lesser toes. Insertion: outside of base of first phalanx of second small toe. Use: to draw this toe out.

Of the adductor tertii digiti?—Origin: from opposite roots of metatarsal bones of third and fourth small toes. Insertion: outside of root of first phalanx of third small toe. Use: to draw the toe out.

Of the abductor medii digiti? — Origin: inside of metatarsal bone of second small toe. Insertion: inside of first phalanx of second toe. Use: to draw the toe inwards.

Of the abductor tertii digiti? — Origin: inside of metatarsal bone

of third toe. Insertion: inside of base of first phalanx of third toe. Use: to draw the toe inwards.

Of the adductor digiti minimi?—Origin: inside of base of metatarsal bone of fourth small toe. Insertion: into the inside of first phalanx of little toe. Use: to draw the toe inwards.

How many muscles belong to the head and neck? — Seventy.

How many muscles are on front of the thorax? — Fifty-two.

How many belong to the front of the abdomen? — Twelve.

How many on the upper posterior parietes of the abdomen?—Nine.

How many belong to the posterior part of the trunk? — Thirty-three.

How many muscles belong to each upper extremity? — Forty-six.

How many to each lower extremity? — Fifty-two.

BURSÆ MUCOSÆ AND FASCIA GENERALLY.

What are the bursæ mucosæ?—They are mucous bags of a delicate transparent texture, and whose internal surfaces are lubricated by a synovial fluid.

What are their use? — To allow the ready play of tendons over bones, &c.

Where are they generally situated? — They are chiefly situated in the extremities between tendons which rub against each other; or where they play on the surface of bones or joints, and between the integuments and certain prominent points of bone, viz.: at the knee, elbow, and knuckles.

What is their structure?—Similar to that of the synovial membranes of joints.

How are they connected with the surrounding parts?—They adhere with great firmness to the parts by means of cellular tissue.

What is their internal arrangement? — Their internal surfaces are in contact, and are only lubricated by the synovial fluid which is formed in them.

What are the fasciæ?—Tendinous expansions, to brace and protect the muscles whilst in action, and support the form of parts; they are sometimes called aponeuroses.

Enumerate the more important fascia. — The temporal fascia, the fascia of the arm, the fascia of the forearm, the palmar and the femoral fascia, the fascia of the leg, and the plantar fascia.

What are the attachments of the temporal fascia? — It is attached to the temporal ridges of the os frontis and ossa parietalia, and the upper edge of the zygoma and posterior edge of the os malæ, and temporal process of the os frontis.

From what is the fascia of the forearm principally derived?—From the tendon of the biceps.

Whence is the palmar fascia derived? — From the internal annular ligament, and the tendon of the palmaris longus.

Whence is the femoral fascia derived? — From the tensor vaginæ femoris, and glutæus maximus; it is also called the fascia lata of the thigh.

Where are the fasciæ of the extremities strongest? — On the inner and anterior part of the forearm; and the fascia lata at the outer part of the thigh.

ORGANS OF MASTICATION AND DEGLUTITION

MOUTH.

What is meant by the mouth?—That cavity bounded above by the palatine arch, below by the tongue and muscles beneath it, before by the lips, and behind by the velum palati and pharynx. The anterior aperture is called facial; the posterior, pharyngeal.

What bones contribute to form the mouth? — The superior and inferior maxillary, the ossa palati, and the teeth.

What are the external parts of the mouth?—The lips and cheeks; the former are at the exterior aperture of the mouth, covered by a peculiar membrane ranking between mucous membrane and the skin, covered by villi. The latter are muscles, covered externally by integuments, fat, &c., and lined by mucous membrane, and supplied with glands.

What are the commissures of the lips? — The union of the two.

What other parts enter into a description of the lips?—The fossula or groove extending from the septum narium, and the fræna, one for the upper and one for the lower lip, consisting of folds of membrane fixing the lips to the jaws opposite the incisors.

OF THE TEETH.

What are the number of the teeth in the adult? — Thirty-two.

Where are they situated? — In the alveolar processes of each jaw.

Upon what part of the teeth is the enamel thickest? — Upon the tops.

Into what portions is each tooth divided? — It is divided into a large portion external to the socket, called its corona; into a narrow part below this, called its neck; and one, two, or three processes proceeding down from the neck, called the roots. Each tooth, in addition, consists mainly of a modification of bony structure, termed *dentine*, or *ivory*, coated over by calcareous enamel on the crown, and a thin layer of true bone on the root. (See *Physiology*.)

Are the fangs, neck, and corona of each tooth hollow? — Yes.

What passes through these hollows?—A branch of an artery, vein, and nerve.

Into what classes are the teeth divided? — Into incisores, canini, and molares.

What is the number of the incisor teeth?—Eight; four in the front part of each jaw.

What is the form of the incisor teeth?—They somewhat resemble wedges, having a sharp cutting edge.

Which of the upper incisors are the largest?—The two middle ones are the largest in the upper jaw.

Which of the lower incisors are the largest?—The lateral ones.

What is the situation of the canini?—They are placed on each side of the incisors.

What is their number?—They are four in number.

What is their form?—They are larger and more pointed than the incisors, and resemble the tooth of the dog, from which they take their name.

What is the situation of the molars?—They are placed behind the canini.

What are their number?—Twenty.

Which of the molars have been called bicuspides?—The two anterior on each side of both jaws.

What is their form?—They have a double pointed corona, and have one or two fangs.

Which of the molars have been termed dentes sapientiæ?—The posterior molars, one on each side of both jaws.

What is their form?—They have a large irregular corona, and generally but one fang.

What is the form of the third and fourth molars?—They have a large corona, and in the lower jaw have two, and in the upper three roots.

How many teeth compose the first set?—Twenty.

Of what kinds does the first set consist?—Eight incisivi, four canini, and eight molares.

About what time do the teeth begin to appear through the gums?—About the age of six months, though sometimes earlier, and are completed in two years.

When do the teeth begin to be shed?—About seven years of age.

When are the teeth completely shed?—At about fourteen years of age.

What is the immediate cause of the shedding of the teeth?—It is effected by the absorption of the fangs of the first set, and of their sockets.

What are the connexions of the teeth?—They are articulated to the alveolar processes of the jaws.

What are their uses?—They are the direct instruments of mastication, and are of essential use in pronunciation.

What are the internal parts of the mouth?—They are the gums, the palate, the tongue, the amygdalæ, and the salivary glands and ducts.

What is the situation of the gums?—They cover both the sides of the alveolar processes, and surround the necks of all the teeth.

What is their structure? — They are composed of a firm, spongy, elastic, and very vascular substance, firmly adhering, by means of periosteum, to the alveolar processes.

By what membrane are they invested?—By a fine membrane, which is a continuation of that which lines the lips and cheeks.

PALATE.

What is the situation and form of the palate?—It is surrounded by the teeth of the upper jaw, and extends to the great opening of the pharynx; it resembles an arch.

How is it divided, and which part is most anterior?—It is divided into the hard and soft palate; the hard palate is more anterior, and is composed of the palatine processes of the upper jaw and ossa palati.

By what membrane is the palate covered? — The membrane which covers it resembles that which lines the superior and middle parts of the pharynx; it is studded with small glands.

How is the soft part of the palate formed? — The soft palate, or velum palati, is formed by a continuation of that membrane which lines the hard palate and the cavity of the nose, and by various muscles lying in this duplicature.

What is its form?—It resembles an arch, placed transversely above the root of the tongue, and forming anteriorly one continued surface with the hard palate.

To what part is the uvula attached? — To its middle part.

What is its form? — It is a conical body.

What is its structure? — It is formed by a small muscle enveloped in the glandular membrane which lines these parts.

What are the arches of the palate? — They are two folds, which proceed downward and to each side; so that the arch on each side is double.

In what direction do the two arches on each side proceed from the uvula? — The anterior arch runs towards the side of the base of the tongue; and the posterior towards the side of the pharynx.

What is situated between the anterior and posterior arch of the palate on each side? — An irregular glandular body, called the tonsil or amygdaloid gland.

TONGUE.

Describe the tongue. — It is the principal organ of taste, and is concerned in mastication and speech. It is a symmetrical muscular body, extending from the os hyoides to the incisors, and filling the space within the two sides and the body of the lower jaw.

What is the origin, insertion, and use of the constrictor isthmi

faucium?—Origin: middle of soft palate, near the root of the uvula. Insertion: side of tongue, near its root. Use: to close the opening between the mouth and pharynx.

What is the origin, insertion, and use of the palato-pharyngeus?—Origin: middle of soft palate, near the root of the uvula. Insertion: into pharynx, at a space between the middle and lower constrictors, and into superior posterior margin of thyroid cartilage. Use: to draw the soft palate downwards.

Into what parts is the tongue divided? — Into a base and apex, a superior and inferior side, and two edges.

Of what is it composed?—It chiefly consists of soft muscular fibres, intermixed with a medullary or fatty substance.

By what membrane is the tongue invested? — Its upper side consists of a thick membrane, studded all over with small eminences, and covered by a continuation of the cuticle; which is likewise continued over the lower side, but here it is smooth, forming only a fold in the middle, called frænum.

What are the papillæ? — The small eminences on its superior surface.

How many kinds of papillæ are observable on the tongue?—There are three kinds.

Where are the papillæ maximæ situated? — On the basis of the tongue, in small fossulæ.

What is their form? — They resemble in miniature a mushroom, having a narrow neck, and being depressed in the middle. They secrete a salivary or mucilaginous fluid.

Where are the papillæ mediæ situated? — Chiefly on the middle and anterior parts of the tongue.

What is their form and size? — They are slightly convex and cylindrical, and next in size to the maximæ.

Where are the papillæ villosæ and filiforme? — They occupy the whole surface of the upper side of the tongue, and even the interstices of the other papillæ.

What is their form and size? — They are of a conical form, and the smallest papillæ of the tongue.

What is the origin and insertion of the stylo-glossus muscle? — Origin: styloid process. Insertion: side of tongue.

What is the origin and insertion of the hyo-glossus? — Origin: from cornu and body of os hyoides. Insertion: side of tongue.

What is the origin and insertion of the genio-hyo-glossus?—Origin: tubercle on the posterior face of symphysis of lower jaw. Insertion: mesial line of tongue from apex to base, and body and lesser cornu of os hyoides.

What is the origin and insertion of the lingualis? — Origin: fasciculus of fibres on inferior surface of tongue, running from base to apex.

What is the origin and insertion of the superficialis linguæ? —

Origin: it covers the upper surface of the tongue below the mucous membrane, commences on a line with the greater papillæ, and advances to the tip.

Describe the transversalis linguæ. — It consists of small scattered fasciculi which traverse the tongue at right angles.

Describe the verticales linguæ. — They consist of small scattered fasciculi like the preceding, and cross them at right angles in transversing the thickness of the tongue.

OF THE GLANDS OF THE MOUTH.

What are the two classes of glands of the mouth? — Muciparous and salivary.

What are the muciparous glands? — They are whitish, oval, and flattened, and are from a line to two lines in diameter, and are situated: G. labiales on the lips; G. buccales on the cheeks; G. muciparæ linguæ on the posterior part of the upper surface of the tongue; G. palatinæ on the posterior part of the hard palate.

Are not these, more properly speaking, salivary glands? — Yes.

Where are the amygdalæ or tonsils situated? — In the interstice between the arches of the palate on each side.

What is the form of the amygdalæ? — They somewhat resemble the outside of an almond shell, being uneven and covered with several foramina; they are filled with numerous and large follicles.

What is their use? — They secrete a viscid fluid.

Enumerate the salivary glands, their situation and uses. — They are three in number on each side; viz.: the parotid, submaxillary, and the sublingual; they are situated on each side of the mouth, and secrete the saliva or spittle.

What other glands contribute to augment the juices of the mouth? — There are numerous glands distributed under the membrane, lining all parts of the mouth, which perform this office. They are named from the parts on which they are situated; namely, the labial on the inside of the lips, the palatine on the palate, the lingual on the tongue, the buccal on the inside of the cheeks, &c., &c.

PAROTID GLAND.

Where is the parotid gland situated? — It is the largest of the lateral glands; it is situated between the external ear and the ramus and angle of the lower jaw, extending over some part of the masseter muscle.

From what part of the gland does its duct proceed? — Its excretory duct, called Steno's duct, arises from several lesser ducts at its anterior and upper part.

What is its course? — It passes obliquely over the outside of the masseter muscle.

Where does this duct open into the mouth?—It perforates the cheek, and opens into the mouth opposite the interstice between the second and third molar teeth.

SUB-MAXILLARY GLAND.

Where is the sub-maxillary gland situated?—On the inside of the angle of the lower jaw, near the internal pterygoid muscle.

From whence does its excretory duct proceed?—From that side of the gland which is turned to the hypo-glossus. It is called Wharton's duct.

What is its course?—It advances between the genio-glossus and mylo-hyoideus muscles, under the sublingual glands.

Where does this duct open?—On one side of the frænum of the tongue.

SUBLINGUAL GLANDS.

Where are the sublingual glands situated?—Under the anterior portion of the tongue, between the genio-glossus and mylo-hyoideus muscles

Where do its ducts terminate?—It has several small ducts, which open close under the side of the tongue, near the gums, a little farther back than the frænum.

OF THE PHARYNX AND ŒSOPHAGUS.

Describe the pharynx.—It is a large membranous cavity, conical in shape.

How is it situated?—Between the mouth, nares, and larynx, below the cuneiforme process of the occipitis, before the cervical vertebræ, and above the œsophagus.

Of what is it composed?—Of three coats: an external one, muscular, a cellular coat, and a mucous coat.

What is its use?—For deglutition: receiving the food and transmitting it to the œsophagus.

What cavities is it in connection with?—The Eustachian tubes, the posterior nares, fauces and mouth, cavity of the glottis and œsophagus.

What is the origin, insertion, and use of the musculus constrictor pharyngis inferior?—Origin: side of cricoid cartilage, inferior cornu, and posterior part of ala of thyroid cartilage. Insertion: mesial line on back of pharynx. Use: to compress the pharynx, and raise it and the larynx upward.

Of the constrictor pharyngis medius?—Origin: cornu and appendix of os hyoides, stylo-hyoid, and thyreo-hyoid ligaments. Insertion: mesial line and cuneiforme process of os occipitis. Use: to compress the pharynx, and to draw it and the os hyoides upward.

Of the constrictor pharyngis superior?—Origin: petrous bone, lower part of internal pterygoid plate and hamular process, from in-

termaxillary ligament; posterior third of mylo-hyoid ridge, and side of base of tongue. Insertion: cuneiforme process of os occipitis, middle line on back of pharynx. Use: to contract the fauces.

What is the œsophagus? — The tube in front of the spine and behind the trachea, to conduct food from the pharynx to the stomach.

What is its shape and length? — It is cylindrical, and from nine to ten inches in length, increasing in size from above downwards.

Of how many coats is it composed, and what are they? — Three: muscular, cellular, and mucous; the muscular is external, and consists of external longitudinal fibres, and internal circular; the cellular and mucous coats have very little peculiar to them.

What peculiar arteries and nerves supply the œsophagus? — The œsophageal, and nerves from the pneumogastric.

OF THE ABDOMEN.

Where is the abdomen situated? — Between the thorax and pelvis.

How is the cavity of the abdomen formed? — It is bounded above by the diaphragm and the margin of the chest; behind by the five lumbar vertebræ; below by the pelvis; anteriorly and laterally by the abdominal muscles.

Into how many regions is the abdomen divided?—Into nine. The right and left hypochondriac; the epigastric; the right and left lumbar; the umbilical; the hypogastric, and right and left iliac.

What membrane lines the cavity of the abdomen, and is reflected over most of the viscera? — A thin serous membrane, called the peritoneum.

What are the contents of the abdomen?—Besides the peritoneum, it contains the organs of digestion and chylification, viz.: the stomach, intestines, liver, spleen, and pancreas; the urinary organs, viz.: the kidneys, ureters, and bladder; and lastly, part of the organs of generation.

PERITONEUM.

What is the situation of the peritoneum? — It adheres to the inner surface of the abdominal cavity, and is reflected over, invests, and supports the viscera.

What is its structure? — Serous.

What is the appearance of the outer surface of the peritoneum?— Its outer surface is cellular, and is adherent to the surfaces of the viscera, with which it is in contact.

What is the appearance of its inner surface? — It is very smooth and polished.

How is the peritoneum moistened?—By a serous fluid, discharged from exhalent vessels.

What are the duplicatures of the peritoneum? — They are very extensive and numerous; after having completely invested an organ, the peritoneum passes double to the parietes of the abdomen, to be there

expanded; these duplicatures confine the organs in their places, and support them. They are sometimes called ligaments; the extensive one which supports the intestines is called the mesentery; and a very large one, hanging loose before the intestines, is called the omentum.

What are the processes of the peritoneum?—They are elongations, which accompany parts in their exit from the cavity of the abdomen.

What ligamentous cords are seen upon the anterior surface of the peritoneum?—There are four; which are the remains of parts peculiar to the fœtus, viz.: the two umbilical arteries, the umbilical vein, and the urachus.

OMENTA.

What is the omentum?—It is a large duplicature of the peritoneum.

What is its situation?—It hangs loosely before the small intestines.

What is its form?—It resembles a flat bag, whose sides are in contact.

Where is it attached?—Its mouth or opening is attached to the great curvature of the stomach, and to the arch of the colon, and may be separated by inflation.

What is its structure?—It consists of two laminæ connected by cellular substance, between which there are numerous portions of fat.

What is the situation of the little omentum?—It is fixed to the small curvature of the stomach, and to the concave side of the liver.

How does the cavity of the omentum communicate with the abdomen?—It communicates with the abdomen on the right side only, under Glisson's capsule, by a semi-lunar orifice, called the foramen of Winslow.

OF THE CHYLOPOIETIC VISCERA.

STOMACH.

What is the stomach?—The stomach is a membranous bag, into which the food is received, and where it is in part digested.

Where is it situated?—It is situated in the left hypochondrium, and epigastric region.

What is its form?—It is oblong and incurvated; large at one end, and small at the other.

Which is its greater and which its lesser extremity?—The left is the greater, and the right the lesser extremity.

Which is the lesser and which the greater curvature?—The superior is the lesser, and the inferior the greater curvature.

How many openings has the stomach, and what are they called?—It has two: the cardiac and pyloric.

Where are they situated?—The cardiac is at the superior extremity, and the pyloric at the inferior and commencement of the intestinal canal.

How many coats has the stomach, and what are their names?—Four: the peritoneal, muscular, cellular, and mucous.

What is the situation of the peritoneal coat?—It is the most external; it is smooth and lubricated.

Where is the muscular coat? — Immediately within the peritoneal.

Of how many planes of fibres does the muscular coat consist?—Two; an external and an internal.

What is the course of the external plane of fibres? — Longitudinal.

What is the course of the internal plane? — Circularly transverse.

Where is the cellular coat situated?—Immediately within the muscular coat.

What is its structure? — It is cellular or filamentary, containing numerous small glands.

What is the situation of the mucous coat?—It is the most internal coat of the stomach.

What is its structure? — It somewhat resembles the pile of velvet, and is very vascular.

How are the rugæ of the stomach formed? — By the two internal coats being thrown into folds.

What is the direction of these rugæ?—They are chiefly placed in a transverse direction.

Whence are the nerves of the stomach derived?—From the eighth pair, and great sympathetic.

Whence are the arteries of the stomach derived?—They come from the cœliac.

Whence do the veins pass? — To the vena portarum.

INTESTINAL CANAL.

What are the intestines? — They are a long membranous tube, beginning at the pylorus, and ending at the anus.

How are they divided?—They are divided into the large and small intestines; the small being subdivided into the duodenum, jejunum, and ilium; and the large into the cæcum, colon, and rectum.

What is the length of the intestinal canal? — Thirty to thirty-five feet.

DUODENUM.

Where is the duodenum situated?—Immediately below the pylorus.

What is its length?—It is about twelve fingers' breadth, as its name imports

What is its course?—It first bends a little backward and downward, then towards the right kidney, and thence it passes before the renal artery and vein, gradually ascending to the left, before the aorta and the last dorsal vertebra; it then continues its course a little forward, making a small turn.

How is the duodenum fixed?—It is retained in its situation by the folds of the peritoneum, and especially by a transverse duplicature, which gives origin to the meso-colon.

How many coats has the duodenum?—It, with all the rest of the small intestines, has four coats, resembling those of the stomach.

What is peculiar to the peritoneal coat of the duodenum?—It does not invest the whole circumference of the intestine?

What is the peculiarity of the muscular coat of this intestine?—It is thicker than in the jejunum and ilium.

What is the peculiar disposition of the nervous and villous coats of the small intestines?—The nervous and villous coats of the small intestines are much more extensive than the other two, and are thrown into folds, called valvulæ conniventes.

What is the form of the valvulæ conniventes?—They resemble portions of circular planes, having one edge fixed to the intestine, and the other loose.

In what intestines are the valvulæ conniventes largest and most frequent?—In the duodenum they are small, but grow much larger and more numerous in the jejunum, and again decrease in the ilium.

How do the villi of the duodenum differ from those of the jejunum?—They are much less conspicuous in the duodenum than in the jejunum.

Where do the biliary and pancreatic ducts open into the duodenum?—On the short side of its first incurvation there is an opening, which is sometimes the common aperture of the excretory duct of the liver and of the pancreas; at other times the ducts open separately.

JEJUNUM AND ILIUM.

How is the termination of the jejunum distinguished from the beginning of the ilium?—There is no mark of distinction between the termination of the jejunum and the beginning of the ilium; this division is therefore arbitrary. It is usual to consider the superior two-fifths as the jejunum, and the remainder as the ilium.

What is the course of the jejunum?—The jejunum, beginning at the duodenum, bends from right to left, and obliquely forward, making several convolutions; it lies chiefly in the upper part of the umbilical region.

How do the valvulæ conniventes of the jejunum differ from those of the duodenum and ilium?—Those of the jejunum are more prominent, loose, and floating, than in the duodenum, and they gradually diminish in the ilium.

What glands are found in the jejunum and ilium?—The glands of Peyer and Brunner. They exist in irregular clusters.

Where are they most numerous?—Towards the end of the ilium.

MESENTERY.

How is the mesentery formed?—By two layers of the peritoneum, which separate at the loose or folded edge to surround the intestines.

Into what parts is the mesentery divided?—That part which sup-

ports the small intestines retains the name of mesentery; that which fixes the large intestines is called meso-colon.

Where does the mesentery begin? — It begins at the last incurvation of the duodenum.

What is its course? — It passes obliquely from left to right along the vertebræ of the loins.

What is its form? — It is narrow at its upper and lower parts, but chiefly at its upper part; while the middle portion is very broad, and its intestinal edge much plaited.

How are its laminæ connected? — They are connected together by cellular substance.

What is contained between the laminæ of the mesentery? — Numerous lymphatics, arteries, veins, nerves, and glands.

What is the meso-colon? — It is a continuation of the mesentery to support the large intestines.

Where does it commence? — At the extremity of the ilium.

Where is the ligamentum coli dextrum situated? — At the commencement of the meso-colon, under the right kidney.

How is it formed? — By a small transverse fold of the mesentery.

What is the course of the meso-colon after the formation of the ligamentum dextrum? — After the formation of the ligamentum dextrum, the meso-colon ascends towards the right kidney, where it almost disappears by the adhesion of the colon to that kidney and to the first turn of the duodenum; appearing again, it increases in breadth, and passes transversely under the liver, stomach, and spleen, including the great arch of the colon; it then turns downward toward the left kidney.

Where does the meso-colon form the ligamentum coli sinistrum? — Below the left kidney it again becomes short, and forms the ligamentum coli sinistrum.

What is the course of the meso-colon after it forms the ligamentum coli sinistrum? — It widens, but less than in the upper part, and ascends on the left psoas muscle, and continues on to the sigmoid flexure of the colon.

Where is the meso-rectum situated? — Between the rectum and os sacrum, at the upper part, it fixes this gut; it is a continuation of the meso-colon.

LARGE INTESTINE.

CÆCUM.

What is the cæcum? —The cæcum, or blind gut, is a short, roomy pouch, into which the ilium opens.

What is its situation?— It is situated under the right kidney, upon the iliacus internus; its bottom being turned downward.

What is the appendix of the cæcum named? — Appendix cæci vermiformis.

Where does the appendix cæci vermiformis open into the cæcum? On the inner side of its bottom; its other extremity is impervious.

What is its size?—Its diameter is about a quarter of an inch, and is about three inches long.

What is its structure?—In structure it resembles very closely the intestines.

What is its use?—Its use is not understood; it has been thought by some to secrete the odorous matter of the excrement, and by others to be the remains of the vesicula alba of the fœtus.

COLON.

What is the situation of the colon?—The colon forms the greater part of the large intestine; it is situated around the small ones, beginning at the cæcum and ending at the rectum.

What is its course?—It ascends in the right iliac region; it then forms the great arch above the umbilical region, crossing from the right kidney to the lower part of the left hypochondrium; this arch is situated immediately below the liver, gall-bladder, and stomach; thence the colon turns back under the spleen, runs before the left kidney, turns towards the vertebræ, and terminates by a double incurvation.

What is this incurvation called?—It is called its sigmoid flexure.

What holds the colon in its place?—The meso-colon; a duplicature of peritoneum.

What guards the opening of the small into the large intestines?—At the termination of the ilium a pair of valves are situated, called valvulæ coli, or valvulæ cæci, or valvulæ ilii.

What is the form of this opening?—It resembles a fissure, its middle being most open.

What is the structure of the large intestines?—The colon, as well as the cæcum and rectum, have the same number and kind of coats as the small intestines.

What is the character of the muscular coat of the large intestines?—The longitudinal fibres of the muscular coat are collected into three distinct bundles, called the longitudinal bands, beginning at the cæcum; besides these, there are occasionally transverse bands.

What are the cavities called which are formed by the contraction of the bands of the colon?—They are called the cells of the colon.

What are the appendices coli adiposæ?—There are many fatty processes hanging from the outside of the colon and cæcum, called appendices coli adiposæ, or appendices epiploicæ.

RECTUM.

What is the situation of the rectum?—It extends from the last lumbar vertebra to the anus.

What is its course?—It runs in a direct course in the hollow of the os sacrum and coccygis.

In what does the rectum terminate ?—Its external termination is called the anus.

How does the membranous coat of this intestine differ from that of the other intestines ?—It often contains a great quantity of fat.

How does its muscular coat differ from that of the other intestines?—Its muscular coat is thicker, and its longitudinal fibres stronger.

How do its nervous and villous coats differ from those of the other intestines ?—Its nervous and villous coats are larger, and form numerous rugæ.

How are these rugæ arranged ?—Towards the anus they become longitudinal, and towards the inner margin of the anus they form little bags, the openings of which are turned upward.

Is the rectum supplied with glands ?—Yes; it has a great number of mucous glands.

ASSISTANT CHYLOPOIETIC VISCERA.

LIVER.

What is the liver ?—The liver is the largest viscus in the abdomen; it is a solid mass, of a dark red colour, inclined to a brownish-yellow, whose office is to secrete the bile.

Where is it situated ?—It is situated immedietely under the diaphragm, partly in the right hypochondrium, which it nearly fills; and partly in the epigastrium, between the spine and ensiforme cartilage, terminating generally in the left hypochondrium.

What is its form ?—Irregular, being convex superiorly, unequally concave inferiorly, very thick towards the back and right side; it becomes gradually thin towards the left side, and forms an acute edge anteriorly.

How is it divided ?—Into three lobes, viz.: the great or right lobe, the small or left lobe, and the lobulus spigelii.

How is the right lobe divided from the left ?—It is divided superiorly by a membranous ligament, and inferiorly by a considerable fissure.

What is the situation of the lobulus spigelii ?—It is situated on the inferior side of the liver, towards its back part, near the great fissure.

How many depressions are seen on the under side of the liver ?—Seven.

What are the depressions of the liver called ?—First, the great fissure; secondly, one for the sinus of the vena portæ; thirdly, one for the vena cava; fourthly, a furrow between the left lobe and lobulus spigelii, for a venous canal in the fœtus; fifthly, a depression for the gall bladder; sixthly, a superficial cavity caused by the stomach; and, sevently, the great sinus, for the spine and œsophagus, at the posterior part of the left lobe.

Where is the great fissure of the liver situated?—It runs from behind forward, on the inferior side of the liver, between its two lobes.

Where is the sinus of the vena portæ?—It is placed transversely between the eminences on the inferior surface of the great lobe.

Where is the sinus of the vena cava?—It is situated posteriorly, at the extremity of the great fissure, between the great lobe and lobulus spigelii.

Where is the depression for the gall bladder?—It is situated on the forepart of the inferior surface of the great lobe.

How many ligaments does the liver possess?—It is kept in its situation by five ligaments.

What are the names of the ligaments of the liver?—The broad ligament, the round ligament, the right and left lateral ligaments, and the coronary ligament.

How are the ligaments of the liver formed?—The broad, and the right and left ligaments, are continuations or duplicatures of the peritoneum; the round ligament was the umbilical vein of the fœtus, and the coronary ligament is merely a broad adhesion.

To what does the middle or broad ligament of the liver connect it?—It divides the right lobe from the left, and connects the liver to the diaphragm, and to the upper and inner part of the sheath of the rectus abdominis muscle obliquely, so as to be nearer the linea alba below than above.

Where is the round ligament of the liver situated?—It is the remains of the umbilical vein of the fœtus, and is placed in the anterior edge of the broad ligament. It is fixed to the umbilicus, and enters the great fissure.

To what do the right and left ligaments of the liver connect it?—They connect it to the cartilages of the false ribs.

To what does the coronary ligament of the liver connect it?—It connects it to the right ala of the tendinous portion of the diaphragm.

What is the structure of the liver?—It is composed of several kinds of vessels, which by their intertexture form numerous friable corpuscles.

By what are the vessels of the liver enveloped?—By a sheath of cellular membrane, and peritoneal membrane called the capsule of the vena portæ, or Glisson's capsule.

What are the vessels of the liver?—They are the hepatic artery, the vena portæ, and the hepatic veins; to which may be added the excretory ducts and absorbents.

By what vessels is the blood carried to the liver?—By the hepatic artery and vena portæ.

Of what use is the hepatic artery?—It is the nutrient artery of the liver.

What is the use of the vena portæ?—It acts both as a vein and artery; as a vein, it receives the blood from most of the abdominal

viscera; as an artery, it ramifies through the liver, and there is supposed by some to secrete the bile.

How many great branches are generally given off by the vena portæ?—It gives off five principal branches.

In what do the ramifications of the vena portæ terminate?—The terminations of its branches are in villous follicles, or acini, as they have been called.

What is the use of these folliculi or acini?—The bile is secreted in them.

What is the name of the small excretory ducts of the hepatic folliculi?—They are called pori biliarii.

In what do the pori biliarii terminate?—They terminate in one large duct, called the ductus hepaticus.

Where does the hepatic duct terminate?—After joining the duct from the gall bladder, called the cystic duct, it terminates in the duodenum.

How is the blood conveyed from the liver?—The hepatic veins return the blood to the inferior cava.

Whence does the liver derive its nerves?—From the great sympathetic and eighth pair.

GALL BLADDER.

What is the gall bladder?—It is a small bag which contains the bile.

Where is it situated?—In the anterior part of the inferior surface of the great lobe of the liver.

What is its form?—It is pyriform, but in infants often cylindrical.

How is it divided?—Into a body, fundus, and neck.

How is the gall bladder situated when we stand?—It lies in a plane, slightly inclined from behind forward; its fundus being turned forward.

How many coats does the gall bladder possess?—Four.

What is peculiar to the internal coat?—The internal or villous coat is thrown into numerous minute folds, arranged in a beautiful reticular form, filled with small lacunæ, or ducts of follicles, especially near its neck; at which place the folds become longitudinal, and form a kind of small pylorus.

Has the gall bladder any direct connection with the liver?—It is connected by vessels and cellular membrane to the liver; but in the human body, no branches from the pori biliarii have been discovered opening into it.

How is the neck of the gall bladder formed?—It is formed by the contraction and incurvation of the small extremity.

What is the internal appearance of the neck of the gall bladder?—On its internal surface there are several reticular rugæ.

What is the course of the cystic duct?—It proceeds from the neck of the gall bladder, runs near the hepatic duct, and then joins it.

What duct is formed by the union of the hepatic and cystic ducts? —The ductus communis choledochus.

Where does the ductus communis choledochus terminate?—It terminates, frequently, in common with the pancreatic duct, on the inside of the duodenum, or else alone.

What is the course of the bile?—It is secreted by the extremities of the vena portæ in the acini; passes through the pori biliarii and branches of the hepatic duct; by this duct it is conveyed to the ductus communis choledochus; whence, in part, it passes by the cystic duct to the gall bladder; when needed in the intestine, it returns by the cystic duct and mixes in the ductus communis choledochus with fresh bile from the hepatic duct; and lastly, passes into the duodenum.

SPLEEN.

What is the spleen?—It is a soft, sponge-like, fleshy, purple mass, and is very vascular.

Where is it situated?—In the left hypochondrium, at the large extremity of the stomach.

What is its shape?—It is somewhat of an oval form.

Into what parts is it generally divided?—It has an external surface, uniformly convex; an internal surface, divided by a groove into two concavities; the anterior opposed to the stomach, the posterior to the colon and left kidney; two edges, often notched; and two extremities.

What is its structure?—It appears to be of cellular structure, but it is probably a congeries of blood-vessels.

From whence does it receive its blood?—From the splenic artery, which is a branch of the cœliac.

Whence do its veins pass?—To the vena portæ.

From whence does it derive its nerves?—From the great sympathetic and eighth pair.

What is its use?—This is not positively known, but the most probable is that it acts as a diverticulum for the internal venous circulation.—See *Physiology*.

PANCREAS.

What is the pancreas?—It is a long, flat, glandular body, of a grayish-white color.

What is its situation?—It is placed at the back part of the epigastric region, transversely under the stomach, and before the spine, the crura of the diaphragm, the aorta, and vena cava.

How is the pancreas generally divided?—Into a superior and an inferior edge, an anterior and a posterior side, a large and a small extremity.

With what parts are its extremities connected?—Its large or right

extremity is connected to the second incurvation of the duodenum, and its lesser extremity to the omentum, near the spleen.

Where is that part situated which has been termed the lesser pancreas ?—At the lower part of the great extremity, where it is connected with the duodenum.

Where does the duct of the lesser pancreas terminate ? — It passes into the extremity of the duct of the greater pancreas, although sometimes it has a separate opening into the duodenum.

How does the pancreatic duct arise ? — From numerous small branches; and form a large one, called duct of Wirsungius.

What is the situation of this duct ?—It is placed horizontally with the substance of the gland, toward the middle of its inferior edge.

Where does it terminate ?—Sometimes along with the ductus communis choledochus in the duodenum; at others, alone.

What is the structure of the pancreas ?—It consists of a great number of small glandular particles connected loosely together; it resembles the salivary glands.

Whence does it derive its arteries ?—From the pyloric and duodenal, but chiefly from the splenic artery.

Whence does its veins pass ? — They pass into the splenic vein.

From whence does it derive its nerves ? — From the great sympathetic and eighth pair.

OF THE GENITO-URINARY ORGANS.

KIDNEYS.

What are the kidneys ? — They are two glandular bodies of a reddish brown color, destined to secrete the urine.

What is their situation ? — They are situated on the posterior part of the abdomen, on each side of the lumbar vertebræ, between the last false rib and ossa ilia.

What is the difference in the situation of the right and left kidney ? —The right kidney, lying under the great lobe of the liver, is lower than the left, which lies under the spleen.

What is the form of the kidney ?—It somewhat resembles the form of a large bean; its circumference is convex on the outer side, and concave on the inner; the posterior side is broader and flatter than the foreside, and the upper extremity is incurvated and larger than the lower.

What coats does the kidney possess ?—It has no peritoneal investment, but is everywhere surrounded by a proper coat, which consists of two laminæ, of which the external is thin and adheres to the internal; this penetrates the substance of the kidney everywhere by numerous elongations.

What is the structure of the kidney ?—It consists of two substances, namely: an external, termed cortical or secretory substance; and an internal, named medullary substance.

How may the cortical and medullary substances be distinguished from each other?—The medullary substance is of a much paler color, and more dense texture, than the cortical; it is divided into a number of unequal conical portions, which terminate in nipple projections, called papillæ, or mamillary processes.

What is the number of the papillæ? — They vary in number from twelve to fifteen, or more.

What is the name of the cavities in which the papillæ are situated? Each papilla is situated in a small funnel-like cavity, called calix or infundibulum.

What is the name of the cavity in which the calices or infundibula of the kidney terminate? — The infundibula join and form two or three tubes, which ultimately form a large conical cavity, called the pelvis of the kidney; it is placed in part within, but more without the body of the kidney, and is the commencement of the duct of the kidney.

What is the name of the duct leading from the pelvis of the kidney? — The ureter.

What is the course of the ureter? — It descends obliquely, and slightly inflected, from the kidney to the sides of the anterior part of the os sacrum; and passing between the rectum and bladder, terminates in the last of these viscera.

How many coats has the ureter? — Three.

What is the structure of the coats of the ureter? — The external consists of a compact filamentary substance; the middle one of several strata of fibres; and the internal one is of the mucous kind.

Whence are the arteries of the kidneys derived? — The arteries of the kidneys which are called the emulgent, come directly from the aorta.

Whence do the veins of the kidney pass? — The veins, which are called the emulgent veins, pass to the inferior cava.

Whence are the nerves derived? — From the great sympathetic and eighth pair.

What is the situation of the ureter in relation to the emulgent artery and vein? — The emulgent artery and vein, and the ureter, enter the kidney at its inner edge, the artery being uppermost; the pelvis, and beginning of the ureter, behind and below the bloodvessels.

RENAL GLANDS.

What are the renal glands?—They are two small, flat, dark yellow-colored bodies.

Where are they situated? — Immediately above the kidneys, on which they rest.

What is the shape of these glands? — Each gland is of an oblong, irregular, three-sided figure.

What is the internal appearance of these glands?—A cavity is found within them.

What is the form of this cavity?—It is of a narrow and triangular figure.

What is contained in these cavities?—They are full of strong, yellow villi, and a dark bile-like fluid.

Are these glands larger in the fœtus or adult?—They are much larger in the fœtus.

What are the corpora Wolffiana?—Small bodies of fœtal life existing before the end of the fifth month, and when fully developed they conceal the kidneys and supra renal capsules, and are supposed to be vicarious kidneys for the time, and consist of transverse cæcal tubes, and each have an excretory duct leading from their lower part in the sinus uro genitalis, which is peculiar to the fœtal state, and finally becomes, the one the urinary bladder, and from the other the vesiculæ seminales are formed.

Where do the arteries and veins come from?—The arteries come from the emulgents, phrenics, and the aorta, and the veins of the right one terminate in the cava ascendens, and of the left in the left emulgent.

URINARY BLADDER.

What is the urinary bladder?—It is a large membranous bag, which serves as a reservoir for the urine.

What is its situation?—In the lower part of the abdomen, and front of the pelvis, immediately behind the symphysis pubis, above and before the lower part of the rectum.

What is its form?—It is somewhat oviform, rounder above than below when empty, and broader below than above when full.

What parts of the urinary bladder are generally enumerated?—It is divided into a body, a neck turned downward and forward, and a fundus turned upward.

How many coats has the bladder?—Four.

What are their names?—An external or peritoneal, a muscular, a cellular, commonly called nervous, and a villous or mucous coat.

What is the extent of the peritoneal coat?—It only covers the fundus, sides, and back part, to a little within the termination of the ureters.

What is the direction of the fibres of the muscular coat?—They are collected into distinct bundles; the external ones are mostly longitudinal; the middle ones are inclined to each side; and the internal ones become more and more oblique; thus crossing each other in various directions.

What is the nature of the cellular or nervous coat?—It nearly resembles in situation and use the tunic of the same name, in the stomach and intestines.

What is the structure of the internal coat?—It is of firm texture, though not thick; and is thrown into folds or rugæ, when the bladder is empty.

How many openings are there into the bladder?—There are three, situated at the under part.

What is the anterior opening?—The beginning of the urethra surrounded by the neck of the bladder.

What is termed the neck of the bladder?—It is an elongation of the proper coats of the bladder, terminating in the inferior orifice.

Where do the ureters open into the bladder?—At the posterior part.

At what distance are these openings from each other?—Passing obliquely through the coats of the bladder, they open an inch and a half from each other, and from the urethra.

Where is the urachus?—At the top of the bladder, above the symphysis pubis; it ascends between the peritoneum and linea alba to the umbilicus.

What is the use of the urachus?—In the fœtus it is hollow, but its use is not positively understood.

Whence are the arteries of the bladder derived?—From the internal iliac.

Whence do its veins pass?—To the internal iliac veins.

Whence are its nerves derived?—From the sacral and great sympathetic.

MALE ORGANS OF GENERATION.

Of what parts do the male organs of generation consist?—They consist of the testicles, with the epididymis, and vasa deferentia, contained in the scrotum; the vesiculæ seminales, prostate gland, Cowper's glands, and verumontanum, about the neck of the bladder; and lastly, the penis, composed of the corpora cavernosa, corpus spongiosum, glans penis, and urethra.

PENIS.

What are the parts which compose the penis?—The penis consists of the corpora cavernosa, corpus spongiosum, urethra, and glans penis.

What are the integuments of the penis?—The common integuments, devoid of fat, afford a loose and very movable covering to the penis, except on the glans, where they are very firmly adhering, and of much more delicate structure.

What is the præputium?—Immediately behind the corona glandis the integuments form a loose doubling, called the præputium, which in the unerected state cover the glans.

What is the frænum?—A fold of the præputium at the under part of the glans.

What are the corpora cavernosa?—They form the body of the penis; they are two large ligamentary tubes, firmly united together.

Where are they situated?—They are situated by the side of each other.

What grooves are formed by their union?—Their junction is marked by two grooves, of which one is superior, the other inferior and much the largest.

What is situated in the lower groove?—The corpus spongiosum urethræ.

What is situated in the upper groove?—The vena magna ipsius penis.

To what are the ends of the corpora cavernosa joined anteriorly?—They terminate anteriorly by a rounded extremity, which is covered by the glans penis; posteriorly, they are entirely separate, forming the crura penis, which are attached to the edge of the rami of the ischia and pubes.

What is the structure of the corpora cavernosa?—A dense ligamentous sheet forms their external part; internally, they consist of numerous cells, which freely communicate with each other.

How are the corpora cavernosa divided?—They are internally separated from each other by a particular septum, called pecteniformis, which however is perforated by numerous fissures.

What is the urethra?—It is a long membranous canal, extending from the neck of the bladder to the end of the penis.

What is its situation?—It is lodged in the lower groove, between the two corpora cavernosa.

What is its form?—It is not throughout of equal bore, being most dilated in the prostate gland, and also an inch and a half before it, and lastly, just before its external orifice.

What is its structure?—It is a continuation of the membrane which lines the bladder.

What are the lacunæ?—Numerous small openings on its surface leading to minute pouches.

In what direction are the openings of the lacunæ?—Their openings are turned forward.

What is the name of the substance surrounding the urethra?—It is called the corpus spongiosum urethræ, except, at about a finger breadth and a half from its origin at the bladder, where it is termed the membranous part of the urethra.

Where is the membranous part of the urethra situated?—About an inch of its length before the prostate.

Where is the bulb of the urethra situated?—The posterior commencement of the corpus spongiosum is dilated into a conical prominence called the bulb.

Where is the glans penis situated?—It expands over the ends of the corpora cavernosa.

By what is the glans penis perforated?—It is perforated anteriorly by the orifice of the urethra.

Where is the corona glandis?—It is a prominent edge, situated posteriorly to the apex of the glans.

What is the structure of the corpus spongiosum?—It is composed of a congeries of veins.

Whence are the arteries of the penis derived?—From the internal pudic.

What is the course of the veins of the penis?—They receive the blood from the cells of the corpora cavernosa; they then form the corpus spongiosum, which is an extensive plexus of veins; from this several branches pass to the dorsum penis, and join the vena magna penis; this passes under the arch of the pubis, where it opens into another considerable plexus, which surrounds the prostate and neck of the bladder; and finally, the hypogastric veins receive the blood.

How is the erection of the penis effected?—The arteries, acting with increased velocity, distend the corpora cavernosa with blood, where it is retained, on account of the peculiar construction of the veins through whose plexus it flows slowly.

OF THE MUCOUS GLANDS AND APPARATUS.

What are the vesiculæ seminales?—They are two oblong membranous reservoirs.

What is their situation?—They are situated obliquely at the lower and under part of the bladder, and before the rectum; near each other anteriorly, but distant behind.

What is their structure?—They are formed by a convolution of one tube, whose doublings are closely connected together.

What is their internal appearance?—Internally they appear to be composed of cells.

What is their external covering?—They are covered and connected to the bladder and other surrounding parts by cellular membrane.

What is the nature of their internal coat?—It is a villous secreting membrane.

How are they connected with the vasa deferentia?—The vasa deferentia, becoming larger, run between the continuous extremities of the vesiculæ seminales: and the termination of each is partly formed by the contiguous vesicula, so that these extremities communicate on each side.

Where do the vesiculæ seminales open?—Each vesicle, after joining the contiguous vas deferens, pierces the prostate gland, and opens into the urethra.

What is their use?—They secrete a peculiar fluid, and by some are thought to retain the semen.

What is the prostate gland?—It is a firm glandular body.

Where is it situated?—At the neck of the bladder and beginning of the urethra.

What is its form?—It is somewhat of the form, and about the size of a chesnut, broad behind and pointed before

What are its connections with the surrounding parts?—Its basis is turned towards the bladder, its apex towards the urethra, its inferior surface is convex, and connected to the rectum; through its substance, near the superior surface, the urethra passes.

What is its structure?—It is of a spongy but very compact texture, consisting of numerous follicles.

What openings are there from the follicles of the prostate into the urethra?—Their ducts, which are ten or twelve in number.

What is its use?—It secretes a peculiar thin white fluid, which mingles with the semen.

What are Cowper's glands?—They are two bodies about the size of a pea.

Where are they situated?—Before the prostate, near the bulb of the urethra.

Where do their ducts open?—Near the beginning of the urethra.

What is their use?—They contribute a fluid which lubricates the urethra.

What is the verumontanum?—It is a small oblong oval eminence.

How is it situated?—It is situated immediately within the prostate, at the under part of the urethra.

By what is the verumontanum perforated?—Its summit is perforated by the two orifices of the vesiculæ seminales.

OF THE TESTICLES.

What are the testes?—They are two glandular bodies of an oval figure, which secrete the semen, and are contained in the scrotum.

How many coats have the testicles?—Each testicle has two coats, viz.: the tunica vaginalis, and the tunica albuginea.

Describe the tunica vaginalis.—It surrounds the testicles as the pericardium does the heart, adhering only at its posterior and superior part; its internal surface is lubricated by a serous fluid.

What is the tunica albuginea?—It firmly invests the testicle, and gives it support and form.

What is the internal structure of the testes?—When the tunica albuginea is opened, the testicle is seen to consist of an immense number of whitish tubes, called tubuli seminiferi, folded in various ways, and distributed in different fasciculi between membranous septa; the septa are disposed longitudinally, diverging from the posterior edge of the testicle, and form a white body, which may be termed the nucleus of the testicle; at this nucleus the tubuli seminiferi terminate in common trunks, forming the rete testes, which afterwards penetrate the upper part of the anterior extremity of the testes, and are called the vasa efferentia.

What is the epididymis?—It is an oblong flattened body, situated along the lateral external part of the upper edge of the testicle, as far as its posterior extremity, from the common trunks of the tubuli seminiferi or vasa efferentia; it in some measure resembles a flat arch,

slightly concave on the under side, and irregularly convex on the upper side.

What is the course of the epididymis? — Its anterior extremity, called its head, arises from the testicle, and receives the vasa efferentia; its posterior extremity, or cauda, which also adheres, becomes gradually smaller; the whole appears composed of one convoluted tube.

Where does it terminate? — In the excretory duct of the testicle, called the vas deferens.

What is the vas deferens? — It is the excretory duct of the testicle, and is a small white tube of dense structure.

Whence does it arise? — It arises from the epididymis.

What is its course? — It forms, in common with the bloodvessels and nerves of the testicle, the spermatic cord, in the cellular substance of which it ascends to the abdominal ring, being situated behind the vessels: having reached the peritoneum, it separates from the vessels and runs back in a curved direction, through the cellular substance of the peritoneum, descends to the nearest side of the bladder, then passes behind it, covered by its peritoneal coat; it afterwards continues its course towards the neck of the bladder, where it terminates near its fellow. In this course it crosses the umbilical artery and the extremity of the ureter, passing behind the former, and between the latter and the bladder.

What forms the spermatic cord? — The vas deferens, the spermatic artery and veins, lymphatics and nerves, and the whole covered by the tunica vaginalis communis, and the cremaster muscle.

How is the scrotum formed? — It is a loose bag, formed merely by a continuation of the integuments; it is devoid of fat.

What is the raphe? — It is a projecting line, which divides it into two equal parts.

What is the dartos? — The cellular substance on the inside of the scrotum is fibrous, and of a red color; it has, therefore, by some been thought muscular, and called dartos.

What is the septum scroti? — Loose cellular substance everywhere connects the testicles to the scrotum, and forms a septum between them.

OF THE MUSCLES AND FASCIÆ OF THE PERINEUM.

Where is the perineal fasciæ situated? — Just beneath the skin of the perineum, and covers the muscles, and is spread over nearly all the space between the anus and posterior margin of the scrotum, and between the rami of the pubes and ischia, and is firmly fixed to the bones.

What is the origin, insertion, and use of the sphincter ani? — Origin: from the tip of the os coccygis, and surrounds the anus. Insertion: into perineum, transverse perinei and accelaratores urinæ. Use: is to close the anus, and pull down the bulb of the urethra.

Of the sphincter ani internus? — It encircles the lower extremity

of the rectum, close to the mucous membrane, and its use is like the preceding.

What is the origin, insertion, and use of the erector penis ? — Origin : inner surface of the tuber ischii, and from the insertion of the great sacro-sciatic ligament. Insertion : fibrous membrane of the corpus cavernosum or crus penis. Use : to erect the penis.

Of the accelerator urinæ, or ejaculator seminis ?—Origin : it arises from the sphincter ani, the membranous part of the urethra, and crus penis. Insertion : into the middle of the bulb, and completely incloses it. Use : to compress the bulb.

Of the transversus perinei ?—Origin : inside of the tuberosity of the ischium. Insertion : central point of the perineum. Use : to dilate the bulb while it draws up the verge of the anus.

Of the levator ani ? — Origin : posterior part of symphysis pubis, obturator fascia, ilium, inner surface of ischium, and spinous process. Insertion : the anterior fibres into the central point of perineum, and front of rectum ; the middle fibres into side of rectum, and the posterior fibres into the back of rectum, and tendinous raphe from rectum to os coccygis, and into last bones of os coccygis. Use : to elevate the anus.

Of the compressor urethræ ?—Origin : by a tendon from inside of symphysis pubis, an eighth of an inch above the lower edge of the arch. Insertion : below membranous portion of urethra into a narrow tendinous line, which becomes lost in the central point of the perineum. Use : to compress the urethra.

Of the coccygeus muscle ? — Origin : inner surface of the spine ot the ischium. Insertion : extremity of the sacrum and side of coccyx. Use : to strengthen the coccyx and pull it forward.

What is the triangular ligament of the urethra ? — A membrane which fills the space below the symphysis pubis, and answers as a septum between the perineum and the pelvis, in its anterior surface is the bulb of the urethra in contact with it, and behind is the prostate gland, a perforation exists in it through which passes the membranous portion of the urethra.

Where is the pelvic fascia ?—It connects the bladder and the sides of the pelvis. It adheres closely to the periosteum of the pubes, between the upper margin of the thyroid foramen, and the crista of the pubes.

For the Organs of Generation in the Female, see *Obstetrics.*

OF THE ORGANS OF RESPIRATION.

What are the organs of respiration ?—The larynx, trachea, bronchiæ, and the lungs.

What is meant by respiration ?—The inhaling and exhaling the air to and from the lungs, as in inspiration and expiration.

How is inspiration and expiration performed ?—Inspiration, by the

contraction and descent of the diaphragm, and the raising of the ribs, by which means the thoracic cavity is enlarged, and air enters the trachea and cells of the lungs; and expiration is immediately the reverse of this.—See *Physiology*.

LARYNX.

What is the larynx?—An irregular cartilaginous tube, forming the upper extremity of the wind-pipe, and is an organ of the voice.

Where is it situated?—At the upper extremity of the trachea, below the os hyoides, and at the root of the tongue.

Of what is it composed?—Of cartilages and ligaments, and lined by a mucous membrane.

What are the cartilages?—They are, one thyroid, one cricoid, one epiglottis, and two arytenoid.

Describe the thyroid.—It is placed at the anterior part of the larynx; and consists of two halves, which are united, and form an angle projecting forward: its superior edge has a notch in the middle and elevations on each side, and terminates in two cornua, posteriorly, which ascend; its inferior edge is straight, and terminates in shorter cornua, which bend down; its posterior edges are straight, and on the outer side of each ala a line runs, from a small knob near its upper cornu, forward and downward to terminate in another.

Describe the cricoid cartilage.—It is placed below the thyroid, and is the base of the larynx; it is an oval ring of unequal thickness and breadth.

Describe the arytenoid cartilages.—They resemble triangular pyramids, and are placed on the upper margin of the cricoid; when the two are joined together they resemble the mouth of a pitcher.

Describe the epiglottis.—It is placed on the posterior face of the base of the os hyoides; and in form resembles an oval disk, and is useful in preventing articles of food falling into the glottis.

Describe the ligaments of the larynx.—The middle thyreo-hyoid ligament fills the space between the os hyoides and the thyroid cartilage. The lateral thyreo-hyoid ligaments on the posterior margin of this membrane are extended between the cornu major of the thyroid cartilage to the tuberculated extremity of the os hyoides. Thyreo-arytenoid ligaments, two in number on each side of the larynx; the inferior one arises from the middle of the anterior angle of the base of the arytenoid cartilage, and is extended to the inferior part of the entering angle of the thyroid; the superior one arises from the middle of the anterior edge of the arytenoid cartilage, and is inserted in the entering angle of the thyroid.

What is the origin, insertion, and use of the thyreo-hyoideus muscle?—Origin: obliquely from the side of the thyroid cartilage. Insertion: into part of the base, and nearly all the cornu of os hyoides. Use: when the thyroid cartilage is fixed it draws down the

os hyoides, and when the latter is fixed it draws up the thyroid cartilage.

Of the crico-thyroideus?—Origin: forepart of cricoid cartilage. Insertion: lower border of thyroid. Use: to draw the two cartilages obliquely together.

Of the crico-arytenoideus posticus?—Origin: back of cricoid cartilage. Insertion: posterior part of base of arytenoid. Use: to draw the arytenoid back, and make the ligament tense.

Of the crico-arytenoideus lateralis?—Origin: side of cricoid. Insertion: side of base of arytenoid. Use: to draw the latter outwards, and open the chink of the glottis.

Of the thyreo-arytenoideus?—Origin: posterior surface of thyroid. Insertion: anterior edge of arytenoid cartilage. Use: to relax the ligaments of glottis.

Of the arytenoideus obliquus?—Origin: base of one arytenoid cartilage. Insertion: tip of the other. Use: to close the chink of the glottis.

Of the arytenoideus transversus?—Origin: posteriorly, from whole length of one arytenoid cartilage. Insertion: in corresponding manner into the other, and fills the cylindrical concavity of the arytenoid cartilages. Use: to close the chink of the glottis.

Of the thyreo-epiglottideus?—Origin: posterior face of thyroid cartilage. Insertion: into side of epiglottis. Use: to draw epiglottis downwards.

Of the aryteno-epiglottideus?—Origin: superior lateral parts of arytenoid cartilage. Insertion: side of epiglottis. Use: to draw epiglottis downwards.

What is meant by the rima glottis and the glottis?—The opening between the two lower ligaments is the former, and the space between the upper ligaments and duplicature of mucous membrane passing from arytenoids to epiglottis, the latter.

What is the use of the larynx?—It forms the chief part of the organ of voice, and affords a free passage for respiration, and also attachment to numerous muscles.

TRACHEA, BRONCHIÆ, AND GLANDS BORDERING ON THEM.

What is the situation of the trachea?—It is situated anteriorly in the lower part of the neck, between the duplicature of the superior mediastinum.

What is its form?—Tubular, and flattened posteriorly.

What is the structure of the trachea?—It consists anteriorly of segments of cartilaginous circles, forming an incomplete canal, which is membrano-muscular posteriorly, and lined by mucous membrane.

Into what does the trachea divide?—At its termination it divides into two tubes of similar structure, called bronchiæ.

Where does this division take place?—Behind the curvature of the aorta.

How many coats has the treachea? — Four, including the internal lining.

Whence is the external coat derived? — It is a continuation of the cellular covering of the lungs.

What is the second coat? — It is the internal perichondrium to its cartilages.

What forms the third coat? — It has been supposed to be muscular; it completes the circumference of the cartilaginous circles.

Where is the thyroid gland situated? — On the anterior and inferior part of the neck; its middle portion lies on the crico-thyroidei, and its lateral portions on the thyro-hyoidei muscles.

What is its form? — It seems to be composed of two oblong portions, united by their inferior extremities, so as to have some resemblance to a crescent.

What and where is the thymus gland? — It is a gland peculiar to fœtal life, and is situated between the trachea and upper extremity of the sternum, and it is irregularly triangular.

Where are the bronchial glands situated? — About the termination of the trachea and beginning of the bronchiæ.

What are their appearance? — Generally blue.

LUNGS.

Where are the lungs situated? — In the cavity of the thorax; they are two in number.

What is their general form? — They are convex next the ribs, concave next the diaphragm, and irregularly formed next the mediastinum and heart.

Into what portions are the lungs divided? — They consist of a right and a left lung, having between them the heart and posterior mediastinum; the right lung is subdivided into three lobes, and the left into two.

What is the structure of the lungs? — They are almost entirely of a spongy texture, consisting of an immense number of small membranous cells.

By what membrane is the lungs invested? — The pleura pulmonalis.

Where do the bronchiæ ramify? — Within the substance of the lungs.

What is their form? — They are conical tubes; which divide and subdivide, and ultimately become membranous tubes.

Where do they terminate? — In the air cells.

How are the air cells connected? — In bundles called lobuli.

What is the relative situation of the bronchial vessels to the branches of the pulmonary artery and vein? — A branch of the bronchiæ generally lies between one of the pulmonary arteries and pulmonary vein.

What is the interlobular substance? — It is the cellular or spongy substance which surrounds the lobuli, and connects them together.

How many kinds of blood-vessels are there for the lungs? — Two, the one called pulmonary, for the purpose of carrying the blood from the right side of the heart to the lungs for the purpose of aerating it; the other called bronchial, for the nourishment of the substance of the lungs.

How is the pulmonary artery ramified in the lungs? — It divides into two branches, one for each lung; they take the same course as the bronchiæ, and ramifying on the surfaces of the bronchial cells, they form a beautiful plexus, called the rete mirabile of Malpighi.

What veins receive the blood of the bronchial arteries? — The bronchial veins.

Whither do the bronchial veins pass? — They pass irregularly, either to the vena azygos or guttural vein.

What blood do the pulmonary veins receive? — The blood from the pulmonary arteries.

How many pulmonary veins are there? — There are four; two for each lung.

Whither do they pass? — To the left auricle of the heart.

Whence are the nerves of the lungs derived? — From the eighth pair, and great sympathetic.

PLEURÆ.

What is the situation of the pleuræ? — It lines the cavity of the thorax, and closely invests the lungs.

What is its structure? — It is a thin, transparent serous membrane; its outer surface is adherent to the thorax and lungs; its inner surface is smooth and lubricated by serous fluid.

What is the use of this membrane? — To afford a smooth and firm covering to the lungs, a lining to the cavity of the thorax, and to subdivide this into two cavities.

What are the names of the duplicatures of the pleuræ? — The mediastinum.

How is the mediastinum formed? — The portions of the pleuræ which lines the parietes of the thorax on each side meet behind the sternum, unite, and, forming a double membrane, are reflected directly backwards; they then separate to invest the heart, pericardium, and great vessels; they give off the covering to the lungs; and then behind the heart they again approach each other and pass to the bodies of the vertebræ, so that in fact there are two pleuræ, one for each side.

What cavities are situated between the duplicatures of the pleuræ? — There are three, viz.: the anterior, posterior, and middle cavities of the mediastinum.

What are contained in these cavities? — In the anterior we have

the remains of the thymus gland. In the middle we have the heart and its pericardium. In the posterior, the bronchiæ, œsophagus, descending aorta, beginning of intercostal arteries, descending cava, vena azygos, thoracic duct, par vagum, and great sympathetic nerves.

To what part of the sternum is the mediastinum attached?—To the posterior part, a little to the left side.

What names have been given to other parts of the pleuræ?—That part of the pleuræ which covers the lungs has been called pleuræ pulmonalis; and where it lines the thorax, pleuræ costalis.

Whence are the arteries of the pleuræ derived?—Chiefly from the intercostals and bronchial.

Whither do the veins of the pleuræ pass?—With those which correspond with the arteries in name and distribution.

Whence are its nerves derived?—From the intercostals.

CIRCULATORY SYSTEM.

What is the circulatory system?—A congeries of organs, which convey the blood to and from every part of the animal economy.

How is the blood propelled through the system?—By the heart and arteries, and returned again to the heart by the veins.

What is the color of the blood in the arteries and veins?—In the arteries it is bright red, and in the veins of a more purple hue.

Do not lymphatics play a part in the circulatory system?—Yes.

What are the extreme vascular ramifications called?—Capillaries.

Of how many coats are the arteries composed?—Three, an external or cellular, the middle or elastic fibrous coat, with fibres arranged circularly, and yielding readily to a ligature; it also has a few involuntary muscular fibres; the internal coat is a thin easily ruptured serous tissue.

How would you distinguish them from the veins?—By being whiter, more dense, and firmer, and when cut across having a gaping aperture; and by their pulsatory motion in the living subject.

How do the arteries begin at the heart?—By two trunks. The pulmonary trunk from the right ventricle to the lungs, and the aorta from the left ventricle, which is distributed by branches over the whole body.

How do they terminate?—By veins, by exhalents, by glands, in cellular bodies, and by anastomosis.

How are the arteries nourished?—By small vessels called vasa vasorum.

How are the veins distinguished from the arteries?—By being more transparent, less elastic, and having no pulsation.

How is their structure?—Similar to the arteries, but their coats are much thinner.

Where do they begin?—From the extreme branches of the arteries as a general rule, but in some cases by open mouths.

How are they distributed?—As the arteries, but they are more numerous.

What are in the veins which are deficient in the arteries?—Duplicatures of the internal coat called valves, to prevent the reflow of the blood.

What veins are without valves?—Those of the head and viscera.

What are the principal venous trunks?—Six; four pulmonary veins, and the superior and inferior cava.

What are the veins of the heart proper?—The coronary.

BLOOD.

What is peculiar to the blood?—Its consistence of size, its red color, and is nauseous saline taste.

Is it a homogeneous fluid?—No; after a short time when drawn it coagulates, and we have serum and crassamentum.

What is the serum of blood?—A light straw-colored fluid, containing albumen, water, and soda, &c. See *Physiology.*

What is the coagulating lymph of the blood?—It is the fibrin or muscular portion of the blood.

Upon what does the coloring matter of the blood depend?—Upon red globules, which are highly plastic.

Are not these the heavier parts of the blood?—Yes.

What is the coloring principle of these red globules?—Iron.

HEART, PERICARDIUM, &c.

What is the heart?—The hollow muscular organ of the circulation, from which the arteries proceed, and to which the veins return.

Where is it situated?—In the thorax between the sternum and the spine, bounded on the sides by the lungs, and below by the tendinous centre of the diaphragm. It is a hollow muscular organ. Its apex is inclined to the left, just below the fifth rib.

What is its form and size?—Somewhat conical, flattened on its inferior surface, and rounded at its upper part, and generally about five inches from apex to base; three inches diameter of base. Pathologists have made the comparitive size to that of the *fist* of the individual to whom the heart belongs.

How is the heart divided externally?—Into a basis, turned backwards and upwards; an apex, pointing forward and to the left side; a rounded edge to the right, a more acute edge to the left; a superior convex surface, and an inferior flat surface.

What are its divisions internally?—Into four cavities, viz.: two auricles at its base, and two ventricles forming its body.

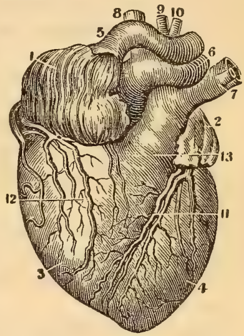
What communications exist between the cavities of the heart?—There is no communication between the two auricles, nor any between

the two ventricles; but the right auricle communicates with the right ventricle, and there is a similar opening between the left auricle and the left ventricle; the two sides of the heart are therefore distinct.

What is the use of the auricles? — They receive the blood from the great venous trunks which are fixed to them, and transmit it to the ventricles.

What is the use of the ventricles? (Fig. 77.) — To propel the blood, the right one through the lungs, and the left one through the general system.

Fig. 77.



What is the situation of the right auricle?[1] — Toward the anterior part of the base of the heart.

How is it divided from the left auricle? — By the septum auricularum.

What are the musculi pectinati? — They are transverse fleshy fibres on the sides of the auricle.

What veins open into the right auricle? — The two venæ cavæ and the coronary vein.

What are the appendices to the auricles? — Small projections from the auricular cavities, like dogs' ears.

Where do the two cavæ enter, and what is the projection called between their mouths? — The superior cava[5] opens at the upper posterior part, and the inferior cava enters at the lower posterior part, and the tuberculum Loweri is situated between the mouths of the cavæ.

Where does the coronary vein enter the right auricle? — Towards the inner and inferior part.

How is the mouth of the coronary veins[8] protected? — By a similunar valve called the valve of Thebesius.

What is the valve of Eustachius? — A fold of the inner membrane, situated to the left of the opening of the inferior cava, near the annulis ovalis; it pertains to fœtal life.

What is the situation of the right ventricle?[3] — At the anterior part of the right side of the heart.

Is the right or left ventricle the largest? — The right is the largest.

What are the columnæ carneæ? — Fleshy pillars, by the contraction of which the valves of the ventricles are closed.

What are the corda tendinæ? — They are the tendons of the columnæ carneæ, by which they are connected to the edges of the valves.

How is the communication or osteum venosum, between the right auricle and ventricle protected? — By the tricuspid valve.

What is the construction of this valve? — It is a tendinous curtain fixed around the circular opening into the ventricle: its opposite

edge presents three points, which are connected to the sides of the ventricle by tendinous cords.

What is the use of this valve?—When the ventricle contracts, this valve prevents the blood from returning into the auricle.

What artery arises from the right ventricle? — The pulmonary artery, at its upper and left side.

How is the mouth of the pulmonary artery protected? — It is guarded by three semilunar valves.

What is the particular form of the semilunar valves? — The loose edge of each resembles two small crescents, uniting in a middle papilla, called corpus sesamoideum aurantii.

What is the use of these valves? — They support the column of blood in the artery, and prevent its returning into the ventricle.

Where is the left auricle situated?[2]—At the superior and posterior part of the left side of the heart.

What difference is there in the size of the left auricle from that of the right? — The left is smaller than the right, and its sides are thicker.

What is its structure? — It resembles that of the right auricle, but is more muscular.

What veins open into the left auricle? — The four pulmonary veins.

What is the situation of the left ventricle?[4]—At the posterior and left part of the heart.

What is its general structure? — It is similar to that of the right, but much more muscular.

How is the communication, or osteum venosum, between the left auricle and ventricle protected? — By the mitral valve.

What is the construction of the mitral valve? — Similar to the tricuspid, excepting that it has only two portions for a valve.

What artery arises from the left ventricle? — The aorta.[6]

How many valves are there at the mouth of the aorta? — Three, called semilunar.

What is their structure and use?—Similar to the pulmonary valves.

Where does the pulmonary artery arise, and what is its course? — It arises from the right ventricle, ascends towards the left, passing before the beginning of the aorta.

How is it divided? — Into two, viz.: the right and left pulmonary arteries,[7] one for each lung, and are distributed throughout the lungs.

How does the right pulmonary artery differ from the left in its course? — It passes behind the aorta and superior cava; and is the longest.

How do they terminate in the lungs? — By minute ramifications, which form upon the surfaces of the air cells, the rete mirabile Malpighii.

How is the circulation of the blood effected?—By the alternate contraction of the auricles and ventricles, called the diastole and systole of the heart.

Describe the course of the blood.—The blood being returned by the superior vena cava from the upper part of the body, and by the inferior vena cava from the lower part, is emptied into the right auricle; this contracts and discharges its contents into the right ventricle; when filled, the right ventricle contracts; by that contraction its tricuspid valve is shut, and its contents propelled through the ramifications of the pulmonary artery into the lungs. The blood is returned by the four pulmonary veins into the left auricle, which being distended, now contracts and throws its blood into the left ventricle; the left ventricle then also contracts, its mitral valve shuts, and its blood is propelled through the aorta and arteries into the capillary vessels of the system. It is again returned by the veins into the two venæ cavæ and the right auricle, to undergo precisely the same process. The mouths of the aorta and pulmonary artery being each protected by three semilunar valves, the blood is prevented passing back from them into the ventricles.

What sensible change is produced on the blood in the lungs?—The venous blood, which is brought to the right side of the heart, is of a dark purple hue; during its passage through the lungs it attracts oxygen from the air in the bronchial cells, and gives out a quantity of carbonic acid gas; when returned to the left auricle, it is found of a bright, florid red color.

What are the arteries which nourish the heart, and whence are they derived? — They arise from the aorta, just after it has left the heart, and are called coronary.[11] [12]

What is their course and distribution? — That which supplies the right side of the heart runs between the right auricle and ventricle; and that which supplies the left side passes between the pulmonary artery and left ventricle.

Where do the coronary veins terminate? — In the great coronary vein, which terminates in the right auricle.

Whence are the nerves of the heart derived? — From the cardiac plexus.

By what is the heart surrounded? — By the pericardium; externally a fibrous membrane, internally a serous; which is reflected over the heart, and roots of vessels.

What are its connexions? — It adheres to the tendinous centre of the diaphragm, below, and to the great vessels at the base of the heart.

How is its inner surface lubricated? — By a serous fluid.

OF THE ARTERIES IN GENERAL.

AORTA.

From what part of the heart does the aorta arise, and what is its course? — It arises from the superior part of the left ventricle, opposite the fourth costo-sternal articulation, and then ascends obliquely

to the right; then curves back, and to the left, as high as the second dorsal vertebra; it then passes down and back to the left side of the spine, to the fourth lumbar vertebra.

How is it generally divided?—It is usually divided into the ascending and descending aorta.

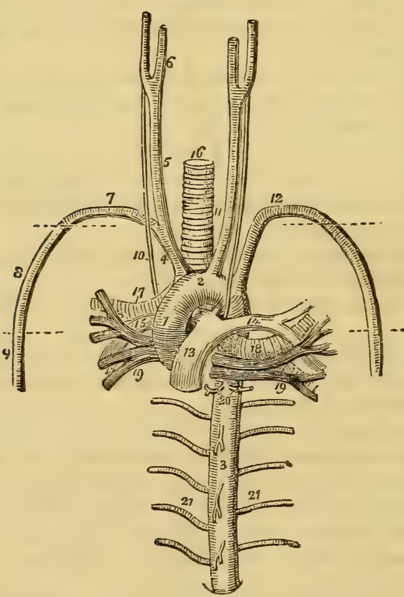
What parts of the body are supplied with blood from each of its divisions? — The head and upper extremities are supplied from the ascending aorta; the trunk and lower extremities from the descending.

What are the capital branches of the aorta? — They are the two subclavians, the carotids, the cœliac, the superior mesenteric, the emulgent, the inferior mesenteric, and the iliac arteries.

What are the smaller branches?—They are the coronary, bronchial, œsophageal, intercostal, inferior diaphragmatic, spermatic, lumbar, and sacral arteries.

Which of the branches of the aorta arise in pairs, and which of them singly? — They all arise in pairs, except the cœliac, the two mesenteric, some of the œsophageal, the bronchial, and sometimes the sacral.

Fig. 78.



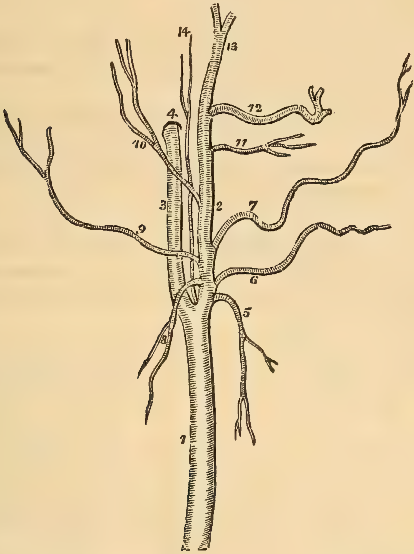
What are the first arteries given off by the aorta? — The coronary.

What are the names of the arteries given off from the arch of the aorta? — The arteria innominata[4] (Fig. 78,) or common trunk of the

right carotid[5] and right subclavian;[7] and the left carotid[11] and left subclavian.[12]

What is the general course of the carotid arteries, and how are

Fig. 79.



they divided?—They run directly to the head, and are divided into the external and internal carotids at[6].

Where is the external carotid distributed?[2] (Fig. 79.)—To the face and external parts of the head.

Where are the internal carotids[3] distributed?—To the brain.

Whither do the subclavian arteries pass, and where do they terminate?—They pass behind and under the clavicles to the upper extremity, and terminate at the upper edge of the first rib.

What name do they assume in passing from the thorax?—Axillary arteries.[8] (Fig. 78.)

What arteries are given off from the thoracic portion of the descending aorta?—The bronchial,[20] œsophageal, below [3] and intercostal arteries.[27]

What arteries does the abdominal portion of the descending aorta give off?—The phrenic, cœliac, superior mesenteric, emulgent spermatic, inferior mesenteric, lumbar, sacral, and iliac arteries.

Whither do the phrenic arteries pass?—To the diaphragm.

Where do the cœliac arteries go?—To the stomach, spleen, and liver.

What parts do the superior mesenteric supply?—The mesentery, small intestines, &c,

Where do the emulgent arteries go? — To the kidneys.

Where do the remainder of the branches go? — The spermatic to the testes, the inferior mesenteric to the great intestines, the lumbar to the loins, and the sacral to the sacrum.

How does the aorta terminate? — In the two iliac arteries, which pass to the pelvis and lower extremities.

How are the iliac arteries divided?—Into the external and internal iliacs; the internal iliacs go to the pelvis, the external pass to the thighs and lower extremities.

Where do they terminate? — Under Poupart's ligament.

What name does the external iliac assume on passing from the abdomen? — The continuations of the external iliacs on the lower extremities, are called the femoral arteries.

OF THE CAROTIDS AND THEIR BRANCHES.

Where do the carotids arise? (Figs. 78, 79, *supra.*)—The right[5] arises from the arteria innominata, and the left[4] is the next capital branch given off by the aorta.

What is their course? — They ascend on each side of the trachea, between it and the internal jugular vein, as high as the larynx, without giving off any branches; and in this course are called the primitive carotids.

How are they divided? — Opposite to the os hyoides they divide into the external and internal carotids.

What is the relative situation of the external and internal carotid arteries? — The external is situated before and to the inside of the internal, at their origin.

What is the general course of the external carotid artery? — It ascends behind the angle of the lower jaw, passes under and sometimes in the substance of the parotid gland, and terminates opposite the condyle of the lower jaw.

How many branches does it give off, and what are their names? — It gives off nine branches, viz.: anteriorly, the superior thyroideal,[5] the lingual,[6] the external maxillary or labial, and the fascial;[7] posteriorly, the occipital,[9] the posterior auris;[10] interiorly, the ascending pharyngeal; and lastly, it divides into the temporal,[13] and the internal maxillary,[12] also a small laryngeal branch.

Where does the superior thyroideal artery[5] arise, and what is its course and distribution? — It arises from the inner side of the external carotid near its origin; and immediately after its origin, it bends downwards and gives branches to the jugular glands, the fat, and the skin; then runs transversely, and is distributed to the thyroid gland and larynx, as well as slightly to the pharynx.

What is the next branch given off? — The lingual,[6] which passes over the cornu of the os hyoides to the muscles of that bone and of the tongue, and to the sublingual gland;[3] then loses itself in the tongue, where it has been called the ranial artery.

What is the next branch given off?—The external maxillary or labial, (Fig. 80,) which arises anteriorly, and passes over and just before the masseter, and middle of the lower jaw; it then runs under the depressor anguli oris, supplying it, the buccinator, and the quadratus; it sends off first, the submental, below the chin—next, a contorted branch, which, dividing at the commissure of the lips, runs along their edges, and forms, with its fellow, the coronaria labiorum; it then ascends towards the nose, and is distributed about it; it afterwards reaches the inner angle of the palpebræ, and dispenses several branches.

Fig. 80.

The letters mark the general distribution of the different arteries, according to the text.

What is the next branch given off?—The ascending pharyngeal, arising from the inner side of the external carotid; is of small size, and ascends upon the rectus anticus to the pharynx; and some of its branches enter the cranium.

What branch is next given off?—The occipital,[9] arising posteriorly.

What is its course?—It passes obliquely before the internal jugular vein, and giving twigs to the stylo-hyoideus, stylo-glossus, and digastric, it runs between the styloid and mastoid processes, supplying the muscles and integuments of the os occipitis; it communicates posteriorly with the vertebral and cervical, and superiorly with the temporal artery.

What is the next branch?—The posterior auris,[10] arising posteriorly; is distributed to the external ear.

What is the next branch?—The facial;[7] it arises anteriorly, and passes across before the masseter muscle, and is distributed to it, and to the fat of the cheek.

What artery is next given off?—The temporal.[13]

What is its course and distribution?—It emerges from the parotid gland, ascends over the zygoma, and divides into an anterior, middle, and posterior branch. The anterior or frontal branch supplies the forehead; the middle or parietal branch goes partly to the forehead

and partly to the occiput; and the posterior or occipital branch, to the occiput.

What is the next and last branch?—The internal maxillary;[12] it commences from the termination of the external carotid, and courses just below the cervix of the lower jaw, bending inward, forward, and downward; and then ascends forward to the sphæno-maxillary fissure.

What arteries does the internal maxillary give off?[a] (Fig. 81.)—The arteria meningea media, the inferior maxillary, the alveolar, the infra-orbitar, the palato-maxillary, and the sphæno-palatine; and also various other branches to the adjacent parts, from which they have received names.

Describe the course and distribution of the branches enumerated.—The arteria meningea media[b] passes through the foramen spinosum of the os sphenoides to the dura mater; the inferior maxillary enters[d] the canal of the lower jaw, and goes to the teeth and chin; the alveolar goes to the back teeth of the upper jaw; the infra-orbitar[h] passes along the infra-orbitary canal to the cheek; the palato-maxillary descends in the canal of the same name to the palate; and the sphæno-palatine goes to the cavity of the nose.

Fig. 81.

What is the general course of the internal carotid artery?—At first it forms a curve backward, and is situated more posteriorly than the external; it ascends to the petrous portion of the temporal bone, passes through its canal into the cavernous sinus; it there forms another considerable curve by the side of the sella turcica, and by the side of the internal clynoid process it pierces the dura mater.

Enumerate the branches of the internal carotid.—It sends one branch forward just as it pierces the dura mater, which accompanies the optic nerve through the foramen opticum, called the ophthalmic, which is distributed to the contents of the orbit; it then divides into three branches; namely, the communicans, which runs backwards to join the vertebral; the anterior cerebri; and the media cerebri.

What is the course of the anterior cerebri?—It runs forward and unites with its fellow from the other side, and then divides into two or three branches, which go to the anterior lobes of the brain, the corpus callosum, and to the middle lobes of the brain.

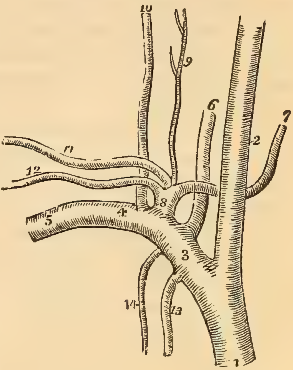
What is the course of the media cerebri?—It is larger than the former; divides into several rami, which supply the superficial parts of the brain, above and below.

OF THE SUBCLAVIAN ARTERIES AND THEIR BRANCHES.

What is the number of the subclavian arteries? (Fig. 82.)—There are two, one going to each arm.

Where do they arise, and what is their course? — The right subclavian[3 4 5] arises from the arteria innominata;[1] the left is the third branch, which proceeds directly from the arch of the aorta, and passes transversely under the clavicles, and over the first rib; the left is the shortest.

Fig. 82.



Where do they change their name? — Above the middle of the first two ribs, between the anterior insertions of the scaleni; they then take the name of axillary arteries.

Enumerate the branches of the subclavian artery. — They run some way without giving off any branches; then each gives off six, viz.: the vertebral,[6] the internal mammary,[13] the cervical,[9 11] the intercostal, the inferior thyroideal,[7] and the supra-scapular arteries,[12] and profunda cervicis.[10]

Where does the vertebral artery arise, and what is its course and distribution? — From the posterior and upper side of the subclavian. It ascends and enters the canal formed in the transverse cervical processes, sending off twigs in its ascent to the medulla spinalis and its membrane, and giving arteries to the vertebral muscles; its course is very tortuous, especially before it enters the cranium, at the foramen magnum occipitis; before entering the cranium it communicates with the cervical and occipital arteries, and immediately after it enters, it gives branches to the medulla oblongata, corpora olivaria, &c.; it then advances on the basilary process of the os occipitis; here, joining its fellow, it forms the basilar artery, which communicates with the branches of the internal carotid, and is distributed to the posterior lobes of the brain.

What is the circulus arteriosus, or the circle of Willis? — The branches of communication between the vertebral arteries and the internal carotids surrounding the sella turcica.

Where does the internal mammary artery[13] arise? — It arises from the anterior and lower side of the subclavian.

What is its course and distribution? — It descends behind the cartilages of the true ribs, an inch from the sternum, giving branches to the thymus gland, mediastinum, pericardium, pleura, intercostal muscles, &c., and passes from the thorax by the side of the ensiform

13

cartilage of the sternum, to the rectus abdominis, where it communicates with the epigastric artery.

Where does the cervical artery arise? — From the upper side of the subclavian.

What is its course and distribution? — It sometimes arises singly, and immediately divides, or its two branches have distinct origins; the cervicalis anterior runs behind the carotid of the same side, and is distributed to the anterior muscles of the neck, and to those of the larynx, pharynx, &c.; the posterior cervical passes under the transverse process of the last vertebra of the neck and runs to the posterior cervical muscles.

Where does the superior intercostal[14] arise, and what is its course? — From the lower side of the subclavian; and it descends on the inside of the two or three uppermost ribs near their heads, and sends off, under each of these ribs, a branch which runs along its lower edge, supplies the intercostal muscles, and contiguous parts of the pleuræ, &c.

Where does the profunda cervicis[10] arise?—Either from the subclavian or superior intercostal, and ascends the back of the neck.

Where does the inferior thyroideal arise? — From the upper part of the subclavian, near the internal mammary.

What is its course and distribution? — It ascends, passes behind the primitive carotid, and is chiefly distributed to the thyroid gland.

Where does the supra-scapula artery arise,[12] and what is its course and distribution? — It arises near the inferior thyroideal, and sometimes from it; and passes to the notch behind the coracoid process of the scapula, and is distributed to the muscles at the back and upper part of that bone.

AXILLARY AND BRACHIAL ARTERIES AND BRANCHES, &C.

Where do the axillary arteries commence? (Figs. 83, 84.) — At the first rib, between the insertions of the scaleni muscles, being the continuations of the subclavian.

Where do they terminate? — Opposite the lower part of the tendon of the latissimus dorsi; the continuation of each is called the brachial artery.

Enumerate the branches of the axillary arteries. — Each axillary artery sends off five or six branches, namely, the external mammary or thoracic arteries, the infra-scapular,[14] the anterior circumflex, and the posterior circumflex.[14] (Fig. 83.)

How many external mammary arteries are there?[11 12] — Usually three or four, but two are chiefly noticed.

Which is the first branch given off by the axillary artery? — The superior mammary.

What is its course? — It descends between the pectoralis major and minor, giving branches to them and to the serratus anticus, latissimus dorsi, &c.

What is the second branch given off, and its course and distribution? — The inferior mammary. It runs along the inferior edge of

Fig. 83.

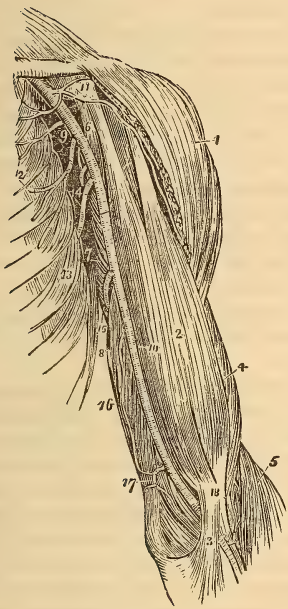
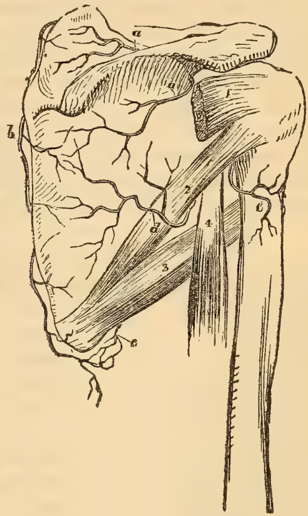


Fig. 84.



the pectoralis major, and is distributed to the adjacent muscles, breast, and skin.

What is the third branch given off, and its course and distribution? — The infra-scapular,[14] which is a very considerable artery, and takes the course of the inferior costa of the scapula, sending branches to the subscapularis, teres major and minor, and large branches to the inferior part of the scapula.

What is the course and distribution of the anterior circumflex artery? — It is small; it runs forwards under the coraco-brachialis, then bends outward, and passes under the deltoid.

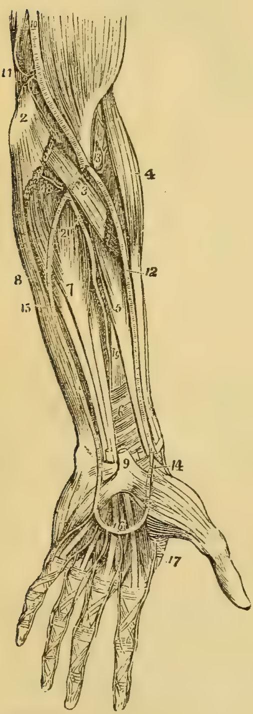
Where does the posterior circumflexe artery arise, and what is its course and distribution? — It is a considerable vessel arising from the lower and posterior part of the trunk; and it runs backward between the head of the os humeri and teres major, surrounding the articulation till it reaches the posterior part of the deltoid, under which it passes and is distributed.

Where does the brachial artery commence? [10]—It is the continuation of the axillary artery, beginning immediately below the tendon of the latissimus.

What is its course?—It descends on the inside of the arm, over the coraco-brachialis, and short head of the triceps, and along the inner edge of the biceps to the middle of the arm.

What branches are given off by the brachial artery above the bend of the arm?—Besides many small branches to the neighboring parts, it sends off, first, the profunda humeri superior,[15] from the inner side of its upper part, which is a long branch, and passes behind the bone, and communicates with the radial artery; secondly, the profunda inferior,[16] about the middle of the arm, which descends towards the inner condyle; thirdly, the anastomodicus magnus,[17] given off a little above the inner condyle, communicating with the arteries of the forearm.

Fig. 85.



What is the situation of the brachial artery at the bend of the arm?—At the bend of the arm it runs under the aponeurosis of the biceps, and under the median vein.

How does the brachial artery terminate? (Fig. 85.)—A little below the bend of the arm it divides into two principal branches; an inner or posterior, named ulnar or cubital;[15] and an outer or anterior, named radial.[12] What is the course of the ulnar artery?—It passes deep under the flexors of the hand and fingers to the inner part of the forearm, along the outer side of the flexor carpi ulnaris and os pisiforme to the palm of the hand; passing over the anterior annular ligament, and under the palmar fascia, and here forming the superficial palmar arch.

What are the chief branches given off by the ulnar before it reaches the wrist?—First, the ulnar recurrent; second, the anterior interosseous artery; and third, the posterior interosseous artery.

What is the course of the ulnar recurrent? [18]—It runs to the inner condyle, then turns up to communicate with the branches of the anastomodicus.

Where is the anterior interosseous given off, and what is its course? [19]—It is given off deeply between the heads of the ulna and radius; it descends close to the interosseous ligament,

passes under the pronator quadratus, behind which it perforates the ligament, and goes to the back of the wrist.

Where is the posterior interosseous[20] given off, and what is its course? — It has usually a common origin with the anterior; and about a couple of inches below the articulation it pierces the interosseous ligament, and having given off a recurrent towards the external condyle of the os humeri, it descends behind the ligament, and is distributed to the muscles on the back of the arm, and communicates with the anterior interosseus and other arteries.

What is the course of the superficial palmar arch? [16]—It crosses the upper part of the palm of the hand, and passes towards the thumb, lying between the palmar fascia and flexor tendons of the fingers.

What branches are given off by it?—It sends off five branches, viz.: the ulnaris profunda, and four digital arteries.

What is the course and distribution of the ulnaris profunda? — It passes deep under the flexor tendons to join the arcus profundus of the radial artery; it also sends a branch to the inner side of the little finger.

What is the course and distribution of the digital arteries? — They are given off in succession; each passes between the heads of two neighboring metacarpal bones; it then splits into two, one branch passing along the inside of one finger, the other branch along the outside of the adjacent finger. The first supplies the outside of the little finger, and inside of the ring finger; the second goes to the outside of the ring finger, and inside of the middle finger; the third to the outside of the middle finger, and inside of the fore-finger; the fourth to the outside of the index, and inside of the thumb.

How does the superficial palmar arch terminate?—By a branch of communication with the radial artery.

What is the general course of the radial artery? [12]— It takes the direction of the radius; it passes over the pronator teres, and at the wrist it lies superficially between the tendons of the flexor carpi radialis, and supinator longus.

What branch does it give off before it reaches the wrist? — In its course to the wrist it gives off the radial recurrent over the outer condyle, to communicate with the anastomosing branches of the brachialis; and in its course downward it supplies, by small branches, the various muscles through which it passes.

What branches does the radial artery give off at the wrist? — It gives off the superficialis volæ[14] to the ball of the thumb and palm of the hand, which often communicates with the superficial palmar arch.

How does the radial artery form the deep palmar arch? — It runs backwards under the tendons of the abductor and extensors of the thumb; between the basis of the first bone of the thumb and of the metacarpal bone of the forefinger, it passes into the palms of the hand, where it forms the arcus profundus.

What is the course of the arcus profundus? — It runs under the

tendons of the flexor muscles close to the bones, and joins the communicating branch of the superficial arch; and gives off a branch to the thumb, and one passes from it between each metacarpal bone.

BRANCHES OF THE DESCENDING THORACIC AORTA.

Enumerate the branches given off by the thoracic portion of the aorta.—The bronchial, the œsophageal, and the inferior intercostal arteries.

Where do the bronchial arteries arise?—They are given off very irregularly, but they generally arise from the fore part of the aorta; there is at least one for each lung, and sometimes more.

What is their course and distribution?—They pass directly to each lung, to the substance of which they are distributed.

Where do the œsophageal arteries arise?—They are from three to six in number, and arise from the fore part of the aorta, and are distributed to the œsophagus.

Where do the intercostal arteries arise?—They arise in pairs along the back part of the descending aorta, all the way to the diaphragm.

What is their course?—They run transversely over the bodies of the vertebræ, and supply the intercostal muscles, contiguous pleuræ, &c.

BRANCHES OF THE ABDOMINAL AORTA.

Enumerate the arteries given off by the abdominal aorta. (Fig. 86.) —The phrenic,[1] the cœliac,[2] the superior mesenteric,[9] the emulgent,[7] the capsular,[6] the spermatic,[10] the inferior mesenteric,[11] the lumbar,[8] and the sacral arteries.[12]

How many phrenic arteries are there, and where do they arise, and what is their course? They are two in number, and arise from the aorta, between the crura of the lesser muscle of the diaphragm, run along the concave side of the diaphragm, and are distributed to its fibres, and to the neighboring parts.

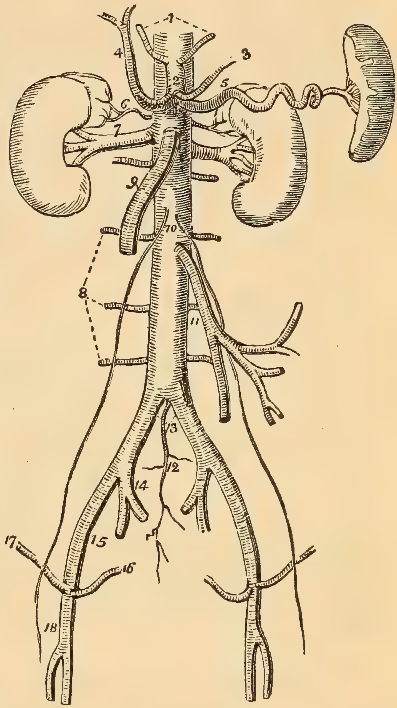
Where does the cœliac artery arise, and what are the distributions? —From the fore part of the aorta, immediately after its passage through the crura of the diaphragm, nearly opposite to the junction of the last dorsal with the first lumbar vertebra, and divides into three great branches, viz.: the coronary of the stomach,[3] the hepatic, and the splenic.[5]

What is the course and distribution of the coronary of the stomach? —It is the least of the three branches; it passes to the left, and having reached the superior orifice of the stomach, it returns along the lesser curvature, giving branches which surround the stomach, and communicates with the pyloric artery.

What is the course and distribution of the hepatic artery?—It runs to the upper and inner part of the pylorus, there giving off, first, the pyloric artery, which is small: and a larger one, the gastro-epip-

loica dextra, which runs along the right side of the great curvature of the stomach, having first at the pylorus given off the duodenal artery to the duodenum; it then proceeds behind the gall ducts towards the gall bladder, to which it gives off the cystic arteries; then divides into two branches, one of which goes to the right and the other to the left lobe of the liver.

Fig. 86.



What is the course and distribution of the splenic artery? — It runs towards the left, hidden behind the pancreas; and towards the spleen, adhering to the pancreas, to which it gives off several branches; the pancreatica, near the extremity of the pancreas, gives off the gastro-epiploica sinistra, to the left portion of the great curvature of the stomach; it then gives the vasa brevia to the great extremity of the stomach; and lastly, it divides into four or five considerable branches, which terminate in the spleen.

Where does the superior mesenteric artery arise, and what is its course? — It arises from the fore part of the aorta, a little below the cœliac, and descends obliquely to the left, at first covered by the pancreas; it then passes over the duodenum, and enters between the two laminæ of the mesentery. In the rest of its course it takes a sweep obliquely from the left to the right, and terminates at the extremity of the ilium; by this means it forms a long arch, from which sixteen or eighteen branches proceed, chiefly to the small intestines; the first and last branches are shorter than the middle ones. These branches join each other by numerous arches: the first considerable branch is the colica dextra, which, passing along the superior part of the colon, communicates with the inferior mesenteric; the second principal branch supplies the last portion of the ilium and the first of the colon, and is called the ilio-colica.

Where does the inferior mesenteric artery arise, and what is its

course? — It arises from the fore part of the aorta, about a finger's breadth below the spermatic arteries, and divides into three or four branches, which are distributed to the large intestines; the first of which communicating with the colica dextra upon the colon, is named colica sinistra: the lower branch sends off the anterior hemorrhoidalis interna to the posterior portion of the rectum.

How many emulgent arteries are there, and where do they arise, and what is their course? — They are two, one for each kidney; they arise from the sides of the aorta, immediately under the superior mesenteric. The right lies more backward, and is longer than the left, passing behind the vena cava: they both lie behind the emulgent veins, and enter the substance of the kidneys behind the vein.

Where do the capsular arteries arise? — The right comes most commonly from the right emulgent, and the left from the aorta above the emulgent.

What is their course and distribution? — They pass directly, and are distributed to the renal capsules.

Where do the spermatic arteries arise, and what is their course?— They arise near each other, from the fore part of the aorta, between the emulgents and inferior mesenteric. They descend obliquely outward, giving off minute branches; in men they pass through the abdominal ring to be distributed to the testes, while in women they remain in the abdomen, and are distributed to the ovaria and uterus.

Where do the lumbar arteries arise, and how are they distributed? —They arise from the posterior part of the abdominal aorta, in five or six pairs, and are distributed on each side of the loins.

Where does the sacral artery arise? — It generally arises from the bifurcation of the aorta; it is distributed to the os sacrum, contiguous peritoneum, &c., &c.

PRIMITIVE ILIAC ARTERIES AND THEIR BRANCHES.

What is the course of the right primitive iliac? [13] — It passes first before the origin of the left iliac vein, and then descends before the right iliac vein.

What is the course of the left primitive iliac? [13] — It descends before and to the outer side of the left vein.

How are they divided? — Opposite the union of the ilium and sacrum, each divides into an internal and external iliac artery.

What is the course of the trunk of the internal iliac? [14] — It passes into the cavity of the pelvis, a little before the sacro-iliac junction; and being directed a little forwards it forms a curve, whose convexity is turned downwards and backwards.

What are the chief branches given off by the internal iliac?—They are the lesser iliac, the gluteal, the sciatic, the pudic, the obturator, and the umbilical arteries.

Where do the lesser iliacs arise, and what are their course? —They

are the first branches given off by the internal iliac, but sometimes they proceed from the gluteal; and pass behind the psoas, and are distributed to the iliacus internus, to the os ilium, to the quadratus lumborum, muscles, &c.

Where does the glutæal artery arise, and what is its course?—It is one of the greatest branches given off, and is the second branch given off by the internal iliac; and passes from the pelvis, along the sciatic nerve, through the greater sacro-ischiatic notch; and is distributed in numerous branches to the glutæus maximus and medius.

What is the third branch given off, and its course?—The sciatic;[14] it is next in size to the gluteal; and after detaching several branches to the rectum, &c., it passes obliquely over the sciatic nerve, accompanying it through the great sacro-ischiatic notch, and descending with it along the posterior part of the thigh, and being distributed to the parts adjacent.

Where does the pudic artery arise?—It generally arises from one common trunk with the sciatic.

What is its course and distribution?—After sending branches to the bladder, rectum, &c., it quits the pelvis through the great sacro-ischiatic notch; then passes behind the spine of the ischium, and again enters the pelvis through the lesser sacro-ischiatic notch; it next runs on the inside of the tuberosity of the ischium, and separates into two, an inferior or perineal artery, and a superior, which is the artery of the penis. The latter runs along the branch of the ischium and pubis to the symphysis; in this course it sends an artery to the bulb of the urethra, and having reached the symphysis pubis, it divides into two branches, one the dorsal, the other the cavernous artery of the penis; the dorsal runs along the superior groove of the penis, the cavernous enters and is distributed within the corpora cavernosa.

Where does the obturator artery arise, and what is its course?—Its origin varies; sometimes it arises from the internal iliac, and sometimes from the lesser iliac; now and then from the epigastric, and rarely from the external iliac; and passes from the pelvis at the upper part of the ligament of the foramen ovale, and is distributed to the pectineus and triceps.

What is there peculiar to the umbilical artery?—It is important to the fœtus, but is nearly obliterated in the adult.

What is its course?—It ascends on the side of the bladder, giving branches to it, the peritoneum, and contiguous parts; and then assumes the form of a ligament, and passes upwards to the umbilicus.

What is the course of the external iliac?—It descends on the iliac muscle as far as Poupart's ligament.

What branches does it give off?—The epigastric, and circumflex iliac.

Where does the epigastric artery arise, and what is its course?—

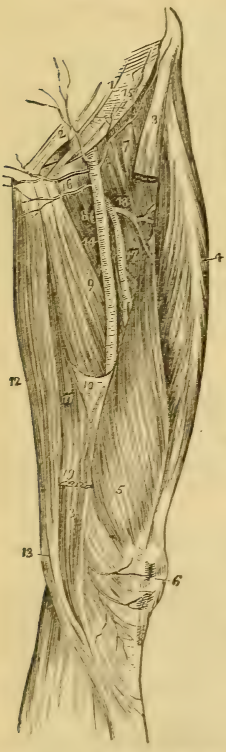
It arises internally from the external iliac, as it passes under Poupart's ligament; and it ascends obliquely behind the tendon of the transversalis abdominis, towards the posterior part of the rectus, behind which it runs, giving branches to the contiguous parts: and terminates by anastomosing with the internal mammary artery.

Where does the circumflex iliac arise, and what is its course?—It arises from the outer side of the external iliac, under Poupart's ligament: and it passes to the inner labium of the crista of the ilium, where it is distributed to the abdominal muscles.

ARTERIES OF THE LOWER EXTREMITIES.

Where does the femoral artery[14] commence? (Fig. 87.)—Immediately after the external iliac passes under Poupart's ligament.

Fig. 87.



What is its course?—It descends over the brim of the pelvis and head of the os femoris; it is placed on the inside of the femoral vein, and is covered only by the skin, fat, and glands; it then descends between the sartorius, vastus internus, and triceps, being covered for a great part of the way by the former. Below the middle of the thigh it passes through the tendinous parts of the triceps, then over the inner ridge of the linea aspera, and below the tendon of the triceps into the ham, where it forms the popliteal artery.

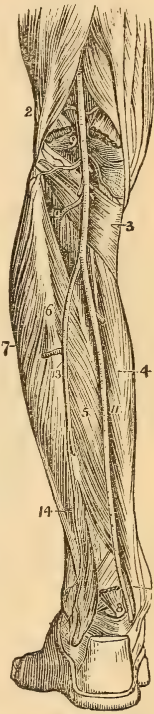
What branches does it send off in the groin?—To the inguinal glands, one or two to the parts of generation, called the external pudics; others to the muscles near the groin, and the profunda.

Where is the profunda[17] given off, and what is its course?—It arises about four inches below Poupart's ligament, from the posterior part of the femoral artery; it is nearly equal in size to the femoral artery. It passes deep betwixt the adductors and vastus internus; it gives off high up, first the circumflex interna,[8 (8)] distributed to the pectinalis, triceps, and obturator, and anastomoses with the obturatory artery; second, the circumflexa externa,[18] near the former, which is distributed to the external and upper part of the thigh, anastomosing with the glutæal; third, the perforantes, usually three in number, sent off lower down and posteriorly, which perforate the triceps, and are distributed to the back part of the thigh.

What name does the femoral artery assume in the hams? (Fig. 88.) — Popliteal.[9]

What branches does it give off? — Two superiorly, called the superior articular, which pass to the upper part of the knee-joint; two inferiorly, to the lower part of the knee-joint, called the inferior articular; and one or two between these, called the middle articular.

Fig. 88.



How does it terminate? — It divides into the anterior and posterior tibial arteries.

What is the course of the anterior tibial?[10] — It passes between the heads of the tibia and fibula, through the interosseous ligament; then descends on its forepart, between the tibialis anticus and extensor digitorum; passes under the common annular ligament; and advances on the convex side of the foot as far as the interstice between the first and second metatarsal bones.

How is the anterior tibial artery distributed? — As it passes between the tibia and fibula it gives off several small branches; it gives off numerous others as it descends upon the leg, and over the upper part of the foot; at its termination it sends off a large branch between the heads of the first and second metatarsal bones, to join the posterior tibial; it also sends several branches over the metatarsal bones, and a considerable one to each side of the great toe.

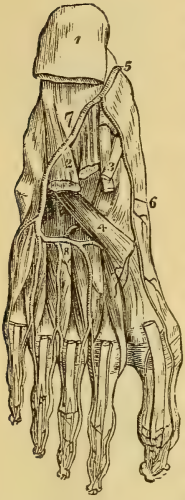
What is the course of the posterior tibial artery, and how is it distributed?[11 14] — It descends between the soleus, tibialis posticus, flexor digitorum communis, and flexor longus pollicis; it then runs behind the inner ankle, and passes to the sole of the foot through the concavity of the os calcis, where it divides into the external and internal plantar arteries; and it gives branches to the muscles as it descends, and the nutrient artery to the bone: it also communicates behind the inner ankle with the anterior tibial.

What is the course and distribution of the external plantar artery?[7] (Fig. 89.) — It passes on the concavity of the os calcis obliquely under the sole of the foot, to the base of the fifth metatarsal bone; thence it runs across, forming the plantar arch, towards the great toe, where it communicates with the large branch of the anterior tibial; from the convex side of this plantar arch[8] branches proceed to the outside of the second toe and to both sides of the three last ones, in the same way as the digital arteries of the hand are given off.

What is the course and distribution of the internal plantar artery?[6]

—Having passed beyond the middle of the sole of the foot it divides, sending one branch to the great toe, where it communicates with the branch of the anterior tibial, and another to the first phalanges of the other toes, communicating with the branches of the arch.

Fig. 89.



What is the course and distribution of the fibular artery?—It descends on the back of the fibula, between the soleus and flexor longus pollicis, giving rami in its course, and about the lower third of the fibula it sends a branch between it and the tibia to the integuments of the tarsus; between the astragalus and tendo-Achillis, it forms an arch with the posterior tibial; thence running outward and above the external ankle, it communicates with the anterior tibial, and sends off several rami.

VEINS.

SUPERIOR CAVA.

Where does the superior cava arise, and how does it terminate?—It arises from the superior part of the right auricle, where it is surrounded by the pericardium; it then ascends a little to the right and backwards, and terminates behind the cartilage of the first rib by dividing into two branches, called the subclavian veins.

What veins does the superior cava receive?—The azygos, the right internal mammary vein, and several lesser branches.

What is the vena azygos?—It is the trunk of the intercostal veins of the right side, and of the inferior intercostals of the left.

What is its course?—It crosses from the left to the right, ascends on the right side of the bodies of the vertebræ, passes behind and above the root of the right lung, and enters the posterior part of the vena cava.

What veins does the right subclavian receive?—The external jugular, the internal jugular, and the vertebral.

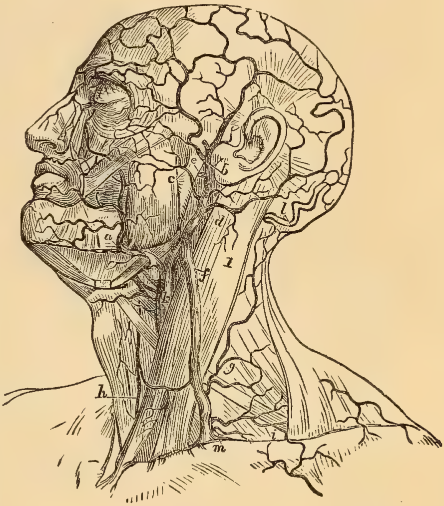
What is peculiar to the left subclavian?—It is by much the longest, passes before and across the arteries going to the head, and receives, besides the same veins as the right, the trunk of the left superior intercostals and the left internal mammary.

What is the axillary vein?—It is a continuation of the subclavian, and receives the blood of the veins, which correspond to the branches of the axillary artery.

VEINS OF THE HEAD AND NECK.

What are some of the veins of minor importance? (Fig. 90.)—The facial,[a] ranini submental, inferior palatine, lingual, pharyngeal, superior thyroid, occipital diploic, superficial temporal, temporal,[b] and internal maxillary.

Fig. 90.



What veins does the external jugular[f] receive?—The frontal vein from the forehead; the angular vein from about the inner angle of the eye; the temporal vein from the temple; the auricular vein, from the ear; the lingual vein, from the tongue; the occipital vein from the occiput; and the suprahumeral vein, from the scapula.

What is its course and termination?—It runs superficially down the neck over the muscles, and passing behind the clavicle, it terminates generally in the subclavian of the same side, but sometimes in the axillary, and sometimes at the union of these two.

How is the internal jugular[k] formed?—It receives branches from the facial and temporal, but is chiefly formed by the sinuses of the dura mater.

What are the chief sinuses of the dura mater?—The cavernous, the circular, the superior and inferior petrosal, the occipital, the inferior longitudinal, the torcular herophili, and the superior longitudinal.

Where is the cavernous sinus situated?—On each side of the sella turcica, at the apex of the petrous portion of the temporal bone.

Whence does it receive its blood?—From the great ophthalmic veins.

Where is the circular sinus situated?—Around the pituitary gland.

Where are the superior petrosal sinuses situated, and whence do they receive blood?—In the groove of the ridge of each os petrosum, and receive blood from the cavernous and circular sinuses.

Where are the inferior petrosal sinuses situated?—Along the suture, formed by each os petrosum and os occipitis.

14

Whence do they receive their blood? — From the cavernous and circular sinuses.

Where is the occipital sinus situated? — In the inferior portion of the internal crucial spine of the os occipitis, and receives blood from the cerebellum.

Where is the inferior longitudinal sinus situated? — On the lower edge of the falx.

Where is the torcular herophili situated, and whence does it receive blood?—In the junction of the falx and tentorium, and receives blood from the inferior longitudinal sinus, and from the vena magna galeni.

Where is the superior longitudinal sinus situated? — In the furrow of the spine of the os frontis, upper edges of the parietal bones, and superior portion of the internal crucial ridge of the os occipitis.

Where are the lateral sinuses placed? — Along the posterior edge of the tentorium, in the grooves of the lateral portions of the crucial ridge of the os occipitis; in those on the inside of the posterior inferior angle of the parietal bones; in those of the inside of the mastoid portions of the temporal bones; and in those on each side of the foramen magnum of the occipital bone.

Whence do they receive their blood? — From the superior longitudinal, torcular herophili, occipital, and petrosal sinuses.

Where do they terminate? — At the jugular foramina, where the internal jugular veins begin.

What is the course of the internal jugular veins, and where do they terminate?—They descend by the sides of the cervical vertebræ, along the edges of the longus colli, behind the sterno and omo-hyoideus, behind the external extremity of the clavicle, and terminate in the subclavian veins.

What is the course of the vertebral vein?—It accompanies the vertebral artery, through the foramina of the transverse processes of the cervical vertebræ.

Whence does it receive its blood?—It receives blood from the lateral sinuses, through the foramen condyloideum posterius and foramen mastoideum, and from the vertebral canal.

Where does it terminate? — It terminates in the upper and posterior part of the subclavian vein.

VEINS OF THE UPPER EXTREMITIES.

How are the veins of the upper extremities classed? — Into deep-seated and superficial.

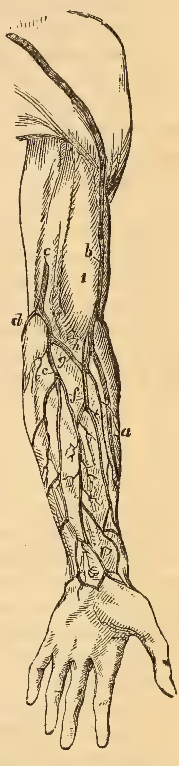
What is the situation and names of the deep-seated veins? (Fig. 91.) — They accompany the arteries, and are axillary, two brachial, two radial, two interosseous, and two ulnar.

What are the superficial veins, and where are they situated? —

They are the cephalic,[b] basilic,[e] and median,[g] and lie directly under the skin.

Where is the cephalic vein situated, and what branches does it receive?—Along the outer and fore part of the arm and forearm, and receives branches from the back of the hand, and from a little below the bend of the arm, &c.

Fig. 91.



Where does it terminate?—It ascends and terminates in the axillary vein.

What is the situation of the basilic vein, and what are the branches it receives?—Along the inner and fore part of the arm and forearm, and receives branches from the ulnar side of the arm and hand, and terminates in the axillary vein.

What is the situation and divisions of the median vein?—Between the cephalic and basilic, and divides into two branches, called median cephalic and basilic.

What is the chief branch which joins it?—The vena profunda, a branch of communication with the deep-seated veins.

INFERIOR CAVA.—VEINS OF THE LOWER EXTREMITIES.

What is the origin of the inferior vena cava?—From the inferior part of the right auricle of the heart.

What is its course?—It pierces the diaphragm; is placed in a notch at the posterior part of the liver; descends along the bodies of the vertebræ to the right side of the aorta; and opposite the junction of the fourth and fifth lumbar vertebræ it divides into two branches, called the iliac veins.

What veins are received by the vena cava?—The two phrenic, or diaphragmatic veins; the four hepatic veins; lower down, the two emulgent, the spermatic veins, and the lumbar veins.

Where do the hepatic veins enter the cava?—At its anterior part, just where it passes behind the liver.

What is the course of the emulgent veins?—They are the veins of the kidneys; and the left is the longest, which passes before the aorta, and receives the left spermatic vein.

What are the terminations of the spermatic veins?—The right enters the vena cava, the left opens into the left emulgent.

What is the course of the primitive iliac veins?—They follow the distribution of the iliac arteries; and divide at the sacro-iliac junction, into the internal and external iliacs.

Whence does the internal iliac receive its blood?—From the veins which correspond to, and accompany the various branches of, the internal iliac artery.

What veins does the external iliac vein receive?—The veins of the lower extremities.

How are the veins of the lower extremities arranged?—Like those of the upper, into a deep-seated and a superficial set.

What are the deep-seated veins of the lower extremity?—The femoral, popliteal, two posterior tibial, two anterior tibial, and two interosseal veins.

What are the names of the superficial veins? — Saphena major and saphena minor.

What is the situation, and what branches does the saphena major receive? — At the inner part of the foot, knee, thigh, receiving branches from the tibial side of the back of the foot, runs along the inner part of the thigh, and terminates in the crural vein.

What is the course of the saphena minor, and where does it terminate? — From the outside of the foot it ascends on the external part of the leg, and terminates in the popliteal vein.

VENA PORTARUM.

What is the vena portarum? — It is a vein peculiar to the liver, with two sets of branches.

What is the vena portarum abdominalis? — It is the one set of the vena portarum, which is distributed over the stomach, intestines, spleen, and pancreas, and receiving their blood.

What is the vena portarum hepaticæ?—It is the set of the branches of the vena portarum, which are ramified through the substance of the liver, secreting the bile, and terminating in the hepatic veins.

What is the situation of the trunk of the vena portarum? — Partly in the transverse fissure of the liver, where it is called the sinus of the vena portarum; and partly in Glisson's capsule.

How is the trunk of the vena portarum formed?—By the junction of the vena mesenterica major, the vena splenica, and the vena mesenterica minor, or hemorrhoidalis interna.

Whence does the vena mesenterica major derive its blood? — From the veins corresponding to the superior mesenteric artery.

What veins does the splenica receive? — From the spleen, from a branch of the coronary vein of the stomach, the pancreatic veins, and the gastro-epiploica sinistra.

Where does the mesenterica minor or inferior derive its blood? — From the inferior mesenteric, and some branches of the cœliac arteries.

What lesser veins join the trunk of the vena portarum? — The cystic, the pyloric, and the duodenal veins; also the gastrica dextra and the coronary vein of the stomach.

ABSORBENT SYSTEM IN GENERAL.

What are the absorbents?—A numerous set of minute transparent vessels, which take up the nutritive part of our food, and the various fluids and solids of the living body.

What division has been made of the absorbents?—Into lacteals and lymphatics.

What difference is there between the lacteals and lymphatics?—The lacteals contain a milk-like fluid, the chyle; and they are the absorbents of the small intestines; while the other absorbents of the body are called lymphatics.

How do the absorbents begin?—By minute open mouths; from all the internal cavities; from the cellular membrane, and every interstice; from the ducts and glands; and from the surface of the skin, stomach, intestines, &c.

What is their general course?—Those of the veins; and in the limbs there are a deep-seated and a superficial set.

How do they terminate?—By two trunks into the subclavian vein, near the angle formed by it and the internal jugular.

What is the thoracic duct?—The left trunk is called the thoracic duct; which receives all the absorbents of the body, excepting those of the right arm and right side of the head, which go to form the right trunk.

What is the structure of the absorbents?—Thin and transparent, but remarkably dense, and stronger than the veins.

How many coats have they?—A muscular and cuticular coat.

How is the cuticular coat disposed?—It is the most internal, and forms pairs of valves in every absorbent vessel.

What are the lymphatic glands?—Small glandular bodies, through which the absorbents convey their contents before they terminate in the common trunks.

Where are they situated?—In clusters in various parts of the body; as just below the occiput, under the ears and jaw, along the side of the neck, in the axilla, at the root of the lungs; in the abdomen, called mesenteric glands belonging to the lacteals; in the loins, pelvis, &c.

What are the vasa inferentia and vasa efferentia?—The absorbents which enter a gland are called vasa inferentia; and those which pass out of the gland, are called vasa efferentia.

What is the structure of these glands?—They appear to be cel lular.

ABSORBENTS OF THE HEAD AND NECK.

How are the lymphatics of the head and neck classed?—Into the facial, temporal, occipital, and thyroideal lymphatics.

What is the course of the facial lymphatics?—They accompany

the trunk and branches of the facial bloodvessels, and pass through several small glands in their course.

What is the course of the temporal lymphatics? — They accompany the temporal bloodvessels, and pass through glands at the root of the zygomatic process.

What is the course of the occipital lymphatics? — They accompany the occipital bloodvessels, pass through glands behind the mastoid process, and descend with the others along the external and internal jugular veins, to join the lymphatics of the upper extremities.

What is the course of the thyroideal lymphatics? — They descend on each side of the trachea through the cervical glands to the commencement of the thoracic duct.

Are there any lymphatics in the brain? — They have never yet been demonstrated.

ABSORBENTS OF THE UPPER EXTREMITY.

What is the course of the superficial lymphatics of the upper extremity? — They follow the course of the cephalic and basilic veins.

What is the course of the deep-seated lymphatics? — They accompany the arteries; there being three or four, or more, lymphatic trunks to each artery.

How do the lymphatics of the upper extremity terminate? — In the axillary lymphatic trunk.

Where does the left axillary lymphatic trunk terminate? — In the thoracic duct.

Where does the right axillary lymphatic trunk terminate? — It terminates in a second trunk, common to it and the lymphatics of the right side of the head.

ABSORBENTS OF THE LOWER EXTREMITIES.

What is the course of the superficial lymphatics of the lower extremities? — They follow the course of the saphena major and minor veins.

What is the course of the deep-seated lymphatics of the lower extremities? — They accompany the arteries; and several lymphatic trunks are found with each artery.

ABSORBENTS OF THE TRUNK.

Describe the lymphatics of the pelvis. — The lymphatics from the nates, and the organs of generation, pass through the inguinal glands; then under Poupart's ligaments to glands situated at the brim of the pelvis. Those from the testicles pass along the spermatic cord to the lumbar glands; those from the cavity of the pelvis generally proceed along the internal iliac arteries; and a third set ascend upon the

psoas magnus. At the posterior part of the pelvis they collect toward the right side, forming a plexus in the right lumbar region, and at the third lumbar vertebra they unite, and being soon joined by the lacteals form the receptaculum chyli.

Describe the lymphatics of the abdomen. — The abdominal lymphatics from the kidneys proceed through glands to a considerable vessel near the aorta; those from the spleen pass along with its artery; those from the pancreas join the lymphatics of the spleen; those from the stomach in part join those of the spleen; others follow the course of the coronary artery, being joined by vessels from the liver; those of the liver either ascend its broad ligament, or join the deep-seated vessels, or ascend in trunks behind the sternum. The lymphatics of the intestines are called lacteals; they run through glands placed in the mesentery to the receptaculum chyli.

Describe the lymphatics of the lungs, &c. — They are either superficial or deep-seated; and passing through the bronchial glands they partly join the thoracic duct behind the bifurcation of the trachea; while some of those from the right lung ascend, and terminate in the great lymphatic vessels which opens between the right subclavian and jugular vein; and others from the left, passing behind the arch of the aorta, terminate near the end of the thoracic duct. The lymphatics of the heart accompany the coronary vessels, and those of the left side terminate with the last-mentioned lymphatics of the lungs, while those of the right terminate between the right subclavian and jugular vein.

Where is the lacteal sac situated? — On the body of the first lumbar vertebra, behind the right crus of the diaphragm and above the right renal artery.

What is its form? — It is irregularly oval, diminishing towards its upper part; being about an inch in length and a third of an inch in breadth.

In what does the lacteal sac terminate? — In the thoracic duct, which proceeds from its upper part.

LEFT THORACIC DUCT.

What is the course of the left thoracic duct? — It passes between the crura of the diaphragm and beneath the right side of the aorta, and ascends between that vessel and the vena azygos to the fifth dorsal vertebra, where that vein in its passage to join the cava covers it. The duct then passes behind the œsophagus and the curvature of the aorta to the left side, till behind the left carotid artery, and on that side of the œsophagus it ascends to the first or second dorsal vertebra, and leaving the carotid, makes a circular turn and divides; uniting again almost immediately, it descends and terminates behind the internal jugular vein, in the upper part of the subclavian vein.

NEUROLOGY.

NERVES IN GENERAL.

What are the nerves?—Long, firm, white cords, which ramify after the manner of the bloodvessels, and are distributed to all parts of the body.

Where do they arise?—From the brain, medulla oblongata, and medulla spinalis.

What communications have the different nerves with each other?—They anastomose; forming sometimes a plexus; at others, a knot, or ganglion is found in the course of the nerves, from which numerous branches arise.

What is the structure of the nerves?—They consist of fasciculi, or bundles of distinct longitudinal fibres, closely connected together by cellular substance.

What are the coverings of the nerves?—Continuations of those which envelope the brain and spinal marrow, now called the neurilema.

What is the structure of the ganglions?—They are of a reddish-grey color, of firm consistence, and formed by a close intermixture of filaments.

How are the nerves classed?—Into cerebral, of which there aro ten pairs; the spinal, of which there are thirty pairs; and the great sympathetic nerve.

How do the cerebral nerves pass out of the cranium?—Through various holes in its basis.

How do the spinal nerves pass out of the vertebral canal?—Through the lateral foramina of the vertebræ, and the anterior foramina of the os sacrum.

Enumerate the cerebral nerves.—The ten pairs of cerebral nerves are: the first pair, or olfactory nerves; the second pair, or optic nerves; the third pair, or motores occulorum; the fourth pair, or pathetici; the fifth pair, or trigemini; the sixth pair, or motores external; the seventh pair, or auditory nerves; the eighth pair, or par vagum; the ninth pair, or lingual nerves; and the tenth pair, or sub-occipital nerves.

How are the spinal nerves divided?—Into cervical, dorsal, lumbar, and sacral. See *Physiology*.

MEDULLA SPINALIS

Whence may the medulla spinalis be said to arise?—It proceeds from the lower extremity of the medulla oblongata.

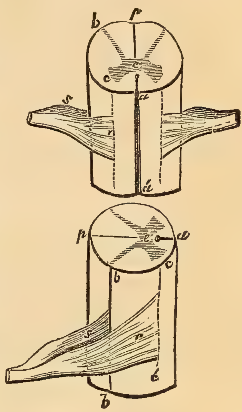
What is its situation?—In the canal of the vertebræ.

By what membranes is it invested?—By the pia mater, tunica arachnoidea, and dura mater, which is a fibrous membrane investing the cord, and attached closely at the foramina, where it affords sheaths

to the nerves; the arachnoid, a serous membrane very thin and transparent, without red bloodvessels; the pia mater consisting of bloodvessels almost exclusively in cellular membrane.

What is its form? — It is somewhat flattened anteriorly and posteriorly; (Fig. 92,) with a groove running anteriorly[a] and posteriorly,[p] each half is again unequally divided by a lateral fissure.[ceb]

Fig. 92.



What is its internal structure? — Like the cerebrum and cerebellum, it consists of a cortical and medullary substance.

What is observed by cutting across the spinal marrow transversely? — The cortical portion presents the appearance of two crescents connected by a commissure. The posterior horns extend to the surface of the lateral fissure, where the posterior roots of the nerves arise.

Where does it terminate? — It terminates pointed, at the os sacrum; towards its end it consists of bundles of nervous filaments, which are called cauda æquina.

What proceed from the sides of the spinal marrow? — Thirty pairs of nerves arising from two roots: the anterior[r] from the anterior column, the posterior[s] from the lateral fissure.

What is peculiar to the posterior root of the nerves? — It is the larger, and in the intervertebral canal is a ganglion, beyond which the anterior and posterior roots unite.

Whence are their arteries derived?—From the vertebrals, intercostals, lumbar, and sacral.

Are there many veins for the spinal marrow? — Yes.

What is supposed to exist in the nervous system? — The seat of intelligence generally.

What are some of the physical functions over which it presides?—The digestion, respiration, secretion, exhalation, &c.

Is not the nervous system among the earliest processes of evolution? —Yes.

What is the ligamenta denticulata? — Narrow transparent bands, very thin, placed one on either side of the medulla spinalis, between the pia mater and the tunica arachnoidea, they commence at the occipital foramen by an adhesion to the dura mater, and terminate above the inferior extremity of the medulla spinalis; it separates the two roots of the nerves.

Where are the arteries of the spinal marrow derived, and what are they? — They are derived from the vertebral, intercostal, lumbar, and sacral, and are the posterior and anterior spinal.

What are the principal veins of the spinal marrow? — The sinus

columnæ vertebralis, in the spinal cavity on the posterior faces, of the bodies of the vertebræ, which sends off numerous anastomosing branches, and form the circelli venosi.

BRAIN IN GENERAL, AND OF ITS MEMBRANES.

Where is the brain situated?—It fills the cavity of the cranium.

How is it divided?—Into the cerebrum and cerebellum, and these again into right and left lobes.

By what membranes is the brain enveloped?—By three mem branes, namely, the dura mater, tunica arachnoidea, and pia mater.

What is the situation of the dura mater?—It is the most external, and by far the more dense, of the three membranes; it lines the inside of the cranium, to which it firmly adheres, and separates and supports the various portions of the brain by means of duplicatures or processes, which consist of two laminæ.

How does the internal differ from the external laminæ?—It has a smooth, polished, and lubricated surface.

How are the processes of the dura mater formed?—By duplicatures of the internal lamina.

What are the chief processes of the dura mater?—The falx cerebri, the tentorium, the falx cerebelli, and the sphenoidal folds.

What are the sinuses of the dura mater?—The two laminæ firmly adhere to each other, excepting opposite the duplicatures of the internal one, where triangular channels are formed, called the sinuses of the dura mater; which are the venous reservoirs of the brain.

What is the situation of the falx cerebri?—It forms a partition along the upper and middle part of the cavity of the cranium, extending from the edge of the crista galli, along the sagittal suture, to the middle of the tentorium.

What is its form, and what portions does it separate?—That of a half crescent; the broadest part or basis of which is turned backwards, and joins the tentorium. It passes between the hemispheres of the cerebrum, and supports each in their various positions in the head.

What is the situation of the tentorium cerebelli?—It is stretched across the posterior part of the cranium, being fixed to the os occipitis, along the grooves of the lateral sinuses, and to the angles of the ossa petrosa, as far as the posterior clynoid processes of the os sphenoides.

Where is the broadest part?—Its middle.

What portions of the brain does it separate?—The cerebrum from the cerebellum, and supports the posterior lobes of the former.

What is remarkable at its anterior part?—An oval notch, through which pass the parts which unite the cerebrum and cerebellum.

Where is the falx cerebelli situated?—It descends from the middle of the tentorium, along the inner spine of the os occipitis to the foramen magnum.

What portions of the brain does it separate? — The hemispheres of the cerebellum.

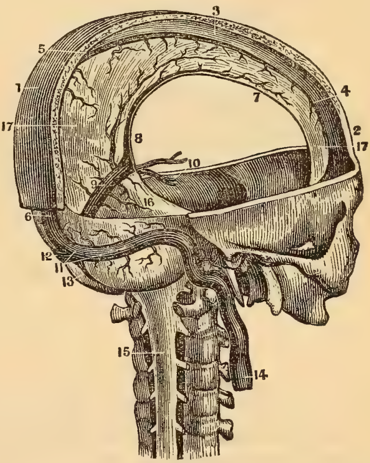
Enumerate the sphenoidal folds of the dura mater. — There are two lateral folds, one on each side of the sella turcica, joining the anterior and posterior clynoid processes; also two anterior folds at the edges of the sphenoidal fissures.

What are the uses of these folds? — The lateral ones form the fossulæ for the pituitary gland, and the anterior ones divide the anterior from the middle lobes of the cerebrum.

What are the elongations of the dura mater? — Productions of both its laminæ, which pass out of the cranium by various apertures, the most important pass through the great foramen, and line the great canal of the vertebræ; the others pass out along with the cerebral nerves.

What are the names of the chief sinuses of the dura mater? (Fig. 93.) — The great sinuses are the superior longitudinal,[4 5 6] in the convex edge of the falx cerebri,[17] terminating in the two lateral sinuses,[11] which are situated in the convex edge of the tentorium; the torcular herophili,[12] formed between the basis of the falx cerebri and the middle of the tentorium; the lesser sinuses are, the inferior longitudinal,[7 8] the occipital, the superior and inferior petrosal, the cavernous, and the circular around the sella turcica.

Fig. 93.



How are the arteries of the dura mater distinguished, and whence are they derived? — Into the anterior, middle, and posterior; the anterior comes from those of the orbit; the middle is a branch of the external carotid, and the posterior from the vertebral arteries.

Whence does it receive its nerves? — From the trunk of the fifth pair, at its entry into the cavernous sinus, and from the eighth pair as it passes out of the cranium.

Where is the tunica arachnoidea situated? — It is a delicate transparent serous membrane, and spread uniformly over the surface of the brain.

What is the situation of the pia mater? — It surrounds and closely invests the whole mass of the brain.

How is the pia mater distributed? — The pia mater forms numerous plicæ, duplicatures, and septa, which pass everywhere between the folds of the cerebrum and cerebellum; it is highly vascular, allowing the vessels of the brain to ramify in it, before they enter that substance.

Where are the glandulæ pachionæ situated? — Along the longitudinal sinus.

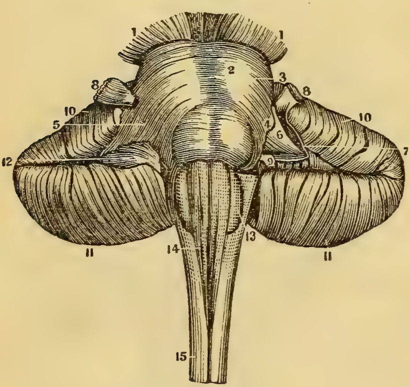
MEDULLA OBLONGATA.

What is the medulla oblongata? — It is a large medullary body, situated in the middle of the basis of the cerebrum and cerebellum.

How is it composed? — By the union of the crura of the cerebrum and cerebellum.

What are the divisions upon the medulla oblongata? (Fig. 94.) — First by an anterior and posterior fissure; and each half has three different divisions: 1st, corpus pyramidale, situated in front;[14] 2d, corpus olivare,[15] behind and above the former, separated by a fissure, presenting in part an appearance called *corpus fimbriatum*, 3d, corpus restiforme posteriorly to *olivare*. The *calamus scriptorius* is formed behind by a continuation of the posterior fissure, across which fibres of medullary matter decussate, giving origin to *auditory nerve*.

Fig. 94.



What are the crura of the cerebrum[1] and cerebellum? — They are the continuations of the medullary substance of those parts which unite at the pons varolii.

How does the medulla oblongata terminate posteriorly? — In the medulla spinalis.[15]

What is the situation of the pons varolii?[2] — It is placed across the union of the cerebri and cerebelli.

What is its form and appearance? — It is a transverse, semiannular protuberance, and its surface is streaked transversely, and divided into lateral parts by a longitudinal depression.

CEREBELLUM.

Where is the cerebellum situated? — In the inferior cavity of the cranium, under the tentorium.

What is its general form?—It is broader laterally than before or behind, and flattened superiorly.

How is it divided?—Into two lobes posteriorly, by the falx cerebelli.

What is its superficial appearance?—It has no convolutions, but on its surface are deep concentric sulci or grooves.

What is its structure?—Like the cerebrum, it consists of two, the cortical and medullary.

What is the appearance called arbor vitæ?—By cutting the cerebellum vertically from above downward, the appearance of the branches of a tree are produced, and in the middle of the trunk of the tree we have the corpus dentatum, a cineritious body.

What are the external eminences of the cerebellum denominated, and where are they?—The appendices vermiformes; one is situated at the anterior and superior part, the other at the posterior and inferior part of the cerebellum.

Where is the fourth ventricle situated?—It runs backward and downward along the middle of the cerebellum.

What opens into it anteriorly?—The iter-a-tertio-ad-quartum-ventriculum.

Where is the valve of Vieussens situated?—At the beginning of the fourth ventricle, immediately behind the iter-a-tertio-ad-quartum-ventriculum.

What is its posterior termination called?—Calamus scriptorius.

Whence do the crura cerebelli proceed?—From the inferior and anterior part of the cerebellum.

CEREBRUM.

Where is the cerebrum situated?—In the superior part, above the tentorium, and its anterior lobes rest upon the anterior and middle of the base of the cranium.

What is its form, and how is it divided?—It is oval, convex above and concave below, and is divided into two hemispheres laterally, and transversely, into anterior, middle, and posterior lobes.

Where are those lobes situated?—The anterior ones are placed in the anterior fossæ; the middle rest in the middle fossæ, and the posterior rest on the tentorium.

What is the fissure between the anterior and middle lobes called?—Fissure of Sylvius.

What is the appearance of the surface of the cerebrum?—It is covered with tuberosities called convolutions.

What are the anfractuosities of the brain?—They are the grooves which separate the convolutions, and penetrate deeply into the substance of the brain; and into these pass the duplicatures of the pia mater.

Of what substances does the cerebrum consist?—Of two kinds:

an external, called cortical or cineritious, and an internal, called medullary.

What is the colour of the cortical or cineritious substance? — Reddish-ash.

What is the colour of the medullary portion? — Of a milk-white hue.

Describe the crura cerebri? — In advance of the pons varolii, and springing from it, are two divergent medullary trunks, one on each side, which run forwards, and are lost in the medullary substance of the brain.

What are the tuber cinerium or pons taurini, the eminentiæ mammillares, and the infundibulum? — The first is a portion of the under surface of the crura cerebri, at the floor of the third ventricle, and is continuous in front with the anerior margin of the corpus callosum. The second are two small bodies situated near the anterior extremities of the crura cerebri, on their internal faces, and are almost in contact. The infundibulum is placed immediately before the latter, is a conical flattened body with the base upwards, and apex downwards and forwards.

Where is the pituitary gland situated? — In the sella turcica.

What is its form? — It is transversely oval, and is sometimes on its lower part divided into two lobes by a small notch.

THALAMI NERVORUM OPTICORUM.

What is the situation of the thalami nervorum opticorum? — On the superior face of the crura cerebri, between the posterior extremities of the corpora striata.

What is their form? — They are convex superiorly, and of an oval shape, but their internal sides are flat, smooth, and in contact.

How are the thalami nervorum opticorum connected? — They are joined at the middle and anterior part of their internal sides by the commissura mollis, a short cord of soft substance.

What is the tenia striata? — It is a white, prominent line, lodged in the groove formed between the corpus striatum and thalamus, on each side.

What is the internal structure of the thalami nervorum opticorum? — Their external surface is white; but internally they are medullary and cineritious.

CORPORA STRIATA.

What is the situation and form of the corpora striata? — At the bottom of the anterior and outer part of the lateral ventricles; and in shape they are pyriform.

What parts of the corpora striata are nearest each other? — Their anterior, being separated only by the septum lucidum.

What is the internal structure of the corpora striata? — They are composed of alternate striæ of the medullary and cortical substances.

CORPUS CALLOSUM.

What is the situation of the corpus callosum? — It is an oblong white body, at the bottom of the fissure which divides the two hemispheres.

What is seen on the surface of the corpus callosum? — A groove, which runs along its middle, called the rapha.

What does the corpus callosum join on each side? — Its edges blend with the medullary substance of the two hemispheres of the cerebrum.

What names are given to the medullary substance of both hemispheres, together with the corpus callosum? — By cutting off the hemispheres of the cerebrum nearly even with the corpus callosum, there is seen a large oval mass of medullary substance, called the centrum ovale.

FORNIX.

What is the fornix? — A medullary body, situated immediately under the septum lucidum, and inferiorly.

What is its form? — Triangular.

What are its connexions? — It is connected by its superior surface to the septum lucidum, and by its posterior edge to the corpus callosum, of which it is a continuation.

What are the continuations of its angles called? — Pillars, or crura.

What names do the posterior pillars assume in the lower part of the lateral ventricles? — Corpora fimbriata.

How do the anterior pillars terminate? — They are double, and dip down at the fore part of the ventricle.

What is the appearance of the inferior surface of the fornix? — It rests on the thalami nervorum opticorum, and is covered by transverse prominent medullary lines called lyra.

SEPTUM LUCIDUM.

Where is it situated?—In the middle line of the brain, and extends from the corpus callosum down to the fornix.

To what bodies is the septum lucidum connected? — To the corpus callosum directly under the rapha, and to the fornix inferiorly.

How is the septum lucidum composed? — Of two laminæ.

What is the name of the cavity situated between the laminæ of the septum lucidum? — The fifth ventricle.

PINEAL GLAND.

Where is the pineal gland situated?—Behind the thalami nervorum opticorum, and above the tubercular quadrigemina, under the posterior part of the fornix.

What is its form? — It is irregularly round, and sometimes conical

How is it connected? — To the lower part of the thalami, by two medullary peduncles.

What is its internal structure? — Mostly of cortical substance, and generally contains a gritty matter.

What is situated below the pineal gland? — Its base is connected with the posterior commissure of the cerebrum, which is a transverse medullary chord towards the posterior part of the third ventricle.

VELUM INTERPOSITUM.

What is this? — A reflection of pia mater separating the pineal gland from the fornix and the thalami nervorum opticorum; on its edges are the *plexus choroides.*

TUBERCULA QUADRIGEMINA.

Where are the tubercula quadrigemina situated? — They are two pairs of medullary eminences, situated behind the thalami nervorum opticorum, and under the pineal gland.

What are their forms?—Each is transversely oblong; the superior, called nates, being a little more rounded and broader than the inferior, called testes. Under them is the fissure of Sylvius.

What are their structure? — Their surface is medullary, and their inner substance cineritious.

LATERAL VENTRICLES.

What are the lateral ventricles? — Two cavities, situated under the corpus callosum, and medullary arches of the cerebrum.

What is their form? — The general course of these cavities would be represented by two C's turned back to back; they are broad and round at their anterior and superior extremities; they then extend backwards, gradually separating from each other, and contracting; they then bend downward, after having sent backward a triangular pointed cavity, which slightly turned inwards, is called cavitas digitalis, or posterior horn; they lastly turn forward, and terminate under their superior extremities, only more backward and outward.

What divides the lateral ventricles from each other? — The septum lucidum.

What is the foramen of Monro? — It is an aperture of communication, between the third and lateral ventricles.

Where is it situated? — Just behind the anterior pillars of the fornix.

What are the cornua of the lateral ventricles?—From their position called anterior, posterior, lateral, or inferior. The first is a small space between the anterior extremity of the corpus striatum, and the opposite surface of the hemisphere. The second extends from the base of the fornix into the substance of the posterior lobe of the cerebrum, is

curved with its convexity outwards, and is furnished on its internal side with an oblong eminence, called hippocampus minor. The third is situated in the middle lobe of the cerebrum, and commences at the posterior angle of the fornix, and winds downwards and forwards. Its floor is furnished in its whole length with an elevated ridge, which is called the hippocampus major; and the termination in the anterior extremity, by small tubercles, is the pes hippocampi.

What is the choroid plexus? — Two loose membranous bodies, of a red, reticular and plexiform appearance.

What is their situation in the lateral ventricles? — They begin small under the anterior part of the fornix, where they are united; as they pass backwards, they increase and extend themselves throughout the whole course of these ventricles.

How are they composed?—They are continuations of the pia mater.

What parts are exposed by the removal of the fornix and choroid plexus? — The eminences of the lateral ventricles, viz.: the corpora striata, and the thalami nervorum opticorum.

THIRD VENTRICLE.

Where is the third ventricle situated? — It is bounded below by the pons taurini, crura cerebri, and eminentia mamillares, and above by the velum interpositum.

Where does it terminate?—At its fore part it extends downwards, under the anterior commissure, and terminates in the infundibulum.

What proceeds from its posterior part? — The iter-a-tertio-ad-quartum-ventriculum.

Where does the iter-a-tertio-ad-quartum-ventriculum terminate? — It passes under the tubercula quadragemina, and terminates in the fourth ventricle.

FOURTH VENTRICLE.

Where is the fourth ventricle? — In front of the tuber annulare and medulla oblongata; behind the fundamental portion of the cerebellum, and above the valve of the brain and the tubercula quadrigemina.

What is called the fifth ventricle?—The division of the laminæ of the septum lucidum.

ARTERIES OF THE BRAIN.

Whence are the arteries of the brain derived?—From the interna carotids and two vertebrals.

Describe the course and distribution of the carotid to the brain. — It gets into the cranium through the carotid canal of the temporal bone; it ascends to the posterior part of the sella turcica, then goes horizontally through the cavernous sinus; after reaching its fore part it again ascends. While in the carotid canal it gives off branches. It sends a small branch to the tympanum, and on the side of the sella turcica it

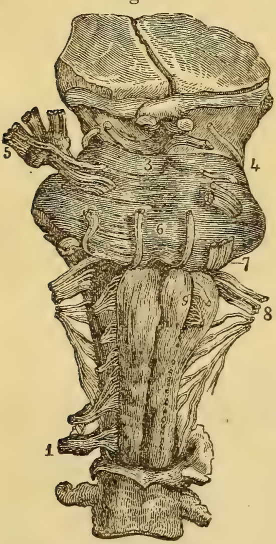
gives off the anterior and posterior artery of the cavernous sinus; at the anterior clinoid process it sends a large branch through the optic foramen, to parts in the orbit of the eye called the ophthalmic artery.

What are the other branches?—After some small branches are distributed to the pituitary gland, infundibulum, and lower part of the third ventricle, we have first, the arteria communicans posterior, running backwards and inwards to the corresponding trunk of the basilar, called posterior cerebral. 2d. The *arteria choroidea*, from the internal carotid going outwards and backwards, and penetrating into the inferior course of the lateral ventricle. 3d. The anterior cerebri coming off opposite the last, advancing in front of the optic nerves, when we have the arteria communicans anterior. Here the internal carotid changes its name, and becomes the arteria media cerebri.

Describe the course and distribution of the vertebral artery of each side.—It ascends through the foramina of the transverse processes of the six upper vertebræ, passes through the occipital foramen into the cavity of the cranium; when at the posterior margin of the tuber annulare the two vertebrals coalesce, and form the *basilar;* at its upper extremity it sends off the Spinalis superior, S. anterior, and Inferior cerebelli.

Where is the basilar artery? — On the middle line of tuber annulare, and extends from its posterior to its anterior margin, sending off branches to the meatus auditorius internus, and the labyrinth of the ear.

Fig. 95.



Where is the arteria superior cerebelli? — Just behind the anterior edge of the tuber annulare, until it gains the front margin of the cerebellum, and is there distributed.

Where is the posterior artery of the cerebrum? — One on each side, and is the termination of the basilar.

What is the circle called which encloses the chiasm of the optic nerves and the corpora albicantia? — The circle of Willis.

CEREBRAL NERVES.

FIRST PAIR.

Where do the olfactory nerves arise? (Fig. 95.) — From the corpora striata.

What is their course and distribution?—They pass forward on each side of the crista galli, reach the os æthmoides without anastomosing, and pass out of the cranium by a great number of filaments, through the holes in the cribriform plate of the æthmoid bone, and ramify on the membrane lining the nose.

With what other nerves does it inosculate? — The ophthalmis and maxillary.

SECOND PAIR.

Whence do the optic nerves arise?[2] — They arise from the thalami nervorum.

What is their course and distribution? — They pass outward and unite before the sella turcica, separate and leave the cranium through the optic foramen, and pass to enter the globe of the eye.

THIRD PAIR.

Whence do the third pair arise?[3] (Figs. 95, 96, 97.)—The third pair, or motores oculorum, arise from the crura cerebri, just before the anterior edge of the pons varolii.

Fig. 96.

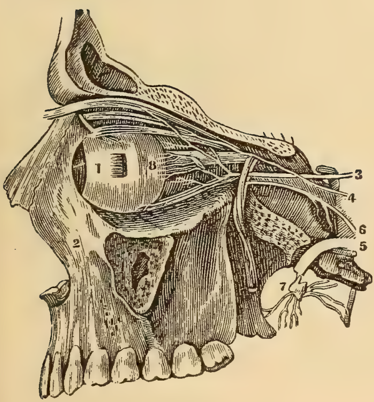
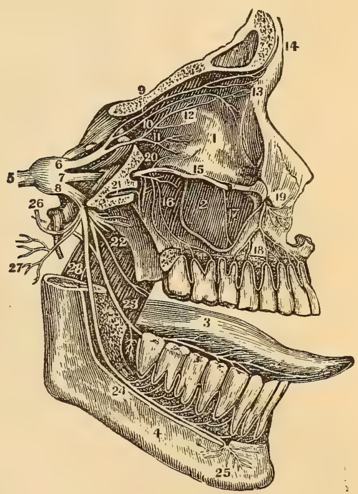


Fig. 97.



What is their course? — They perforate the dura mater behind the posterior clynoid processes, run along the upper part of the cavernous sinus, and pass out through the foramen lacerum superius.

Enumerate the branches of the motores oculi or third pair.[3] — Each sends a branch to the rectus superior, and a ramus to the levator palpebræ superioris; then a branch to the rectus internus; a branch to the rectus inferior; the longest branch to the obliquus inferior; and a branch to the lenticular ganglion.

What is the distribution of the ciliary plexus? — From the lenti-

cular ganglion proceed several filiments, forming the ciliary plexus; which surround the optic nerve, and run to the iris, which they supply.

FOURTH PAIR.

Whence do the pathetici arise? [4]—Behind the nates.

What is their course and distribution? [4] — They pass on each side to the edge of the tentorium, and along the upper part of the cavernous sinus, and pass out through the foramen lacerum orbitale inferius, and terminate in the obliquus superior muscle.

FIFTH PAIR.

Whence do the trigemini arise? [5] — From the sides of the pons varolii, by numerous distinct filaments.

What is their course within the cranium? [5 6 7 8 9] (Fig. 97.) General distribution of this nerve. [10 11 12] — They pass toward the point of the os petrosum, where each perforates the dura mater, and forms a flat semilunar ganglion.

What are the branches of the trigemini? — From the semilunar ganglion, the first, or ophthalmic; the second, or superior maxillary; the third, or inferior maxillary are given off.

How do these branches pass out of the cranium, and to what are they distributed? — The ophthalmic passes through the foramen lacerum orbitale inferius, and sends off a frontal branch, a nasal branch, a lachrymal branch, and branches to the lenticular ganglion and fourth pair. The superior maxillary passes through the foramen rotundum to upper jaw, and sends off the pterygoid branch, the sphæno palatine, the palatine, the infra orbitar filaments to the teeth of the upper jaw. The inferior maxillary passes out through the foramen ovale towards lower jaw, and sends off a temporal branch, a branch to the cheek, a lingual branch or gustatory, a dental branch which enters the canal of the lower jaw, and passes through the mental foramen.

SIXTH PAIR.

Where do the motores externi arise? [6] — Between the pons varolii and the corpora olivaria.

What is their course and distribution? [6] (Fig. 96, *supra.*) — They advance to the dura mater, and perforate it on one side of the junction of the sphenoid and occipital bones; run through the cavernous sinus, by the side of the carotid arteries, to which they closely adhere, communicate with a branch of the fifth pair, send back a filament along the carotid artery, accompanying it in its canal, and joining the great sympathetic, and pass out through the foramen lacerum orbitale superius; and are distributed to the rectus externus oculi.

SEVENTH PAIR.

Where do the auditory nerves arise? [7] (Fig. 95.)—From the lateral and posterior part of the pons varolii.

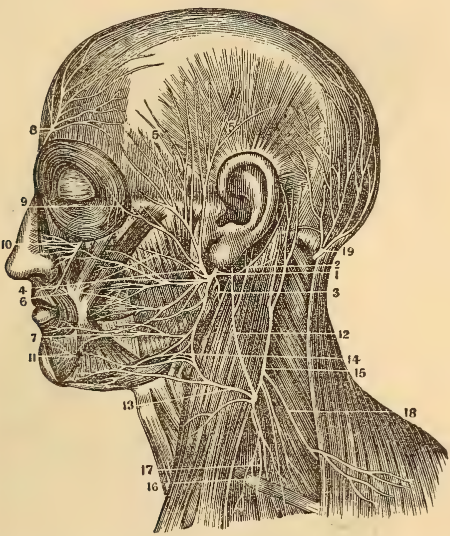
What is their course?[7] — They pass into the meatus auditorius internus of the ear on each side, and consist of two portions; the portio mollis, and portio dura.

What is the relative situation of the two portions? — The portio dura is placed anteriorly; the portio mollis is situated more posteriorly.

What is the distribution of the portio mollis?—It enters the organ of hearing at the basis of the cochlea, and inner side of the vestibulum, and is alone distributed to the labyrinth.

How does the portio dura pass out of the cranium, and what filaments does it give off?[1] (Fig. 98.)—Through the fallopian aqueduct,

Fig. 98.



and stylo-mastoid foramen; and it first gives filaments through the small hole on the superior surface of the os petrosum, to join the pterygoid nerve; then one to the stapedius, and as it goes out, another, which, passing through the tympanum, is called chorda tympani, and joins the lingual branch of the inferior maxillary nerve.

What great branches does the portio dura give off where it emerges from the foramen stylo-mastoideum? — On quitting the stylo-mastoid foramen it forms a plexus, whose branches are widely distributed to the temple,[5] to the eyelids, cheeks,[6] nose, lips, chin, head, and neck, forming what has been called the pes anserinus.[4] *In this figure further reference to the figures will indicate the particular nerve branches.*

With what nerves does the portio dura communicate? — With the three branches of the fifth pair, and with the cervical nerves.

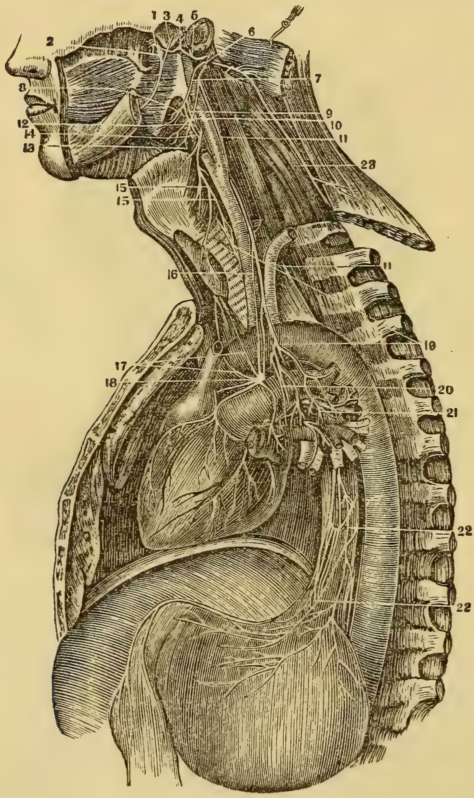
What is Sir Charles Bell's opinion in regard to the portio dura?— That it is the superior respiratory nerve of the face.

EIGHTH PAIR.

Where does the par vagum or pneumogastric nerve arise?[8] (Fig. 95, *supra.*)—From the corpora olivaria, laterally.

Of what portions does the eighth pair consist?—At its commencement it consists of two separate portions; the first called the glosso-pharyngeal nerve, and the second the true par vagum.

Fig. 99.



How do the eighth pair of nerves pass out of the cranium? (Fig. 99.)—They run towards the jugular foramen before the extremity of the lateral sinus, from which the nerve on each side is separated by

two small bony prominences, and a membranous septum; here the glosso-pharyngeal nerve[7] is situated before the par vagum, and separated from it by a thin membranous septum.

Where is the eighth pair joined by the nervus accessorius?—In its passage through the jugular foramen.

What is the course of the nervus accessorius?—It ascends from the spinal marrow, enters the cranium at the foramen magnum occipitis, and joining the par vagum, passes out again to be distributed to tho integuments and muscles at the back of the neck.

How is the glosso-pharyngeal nerve distributed? — To the tonsils, pharynx, and tongue, and sends branches of communication to the fifth, seventh, and ninth pairs.

What is the situation of the par vagum in its passage from the head to the chest? — It passes before and adheres to the ninth pair, and to the superior cervical ganglion of the great sympathetic; it descends along the neck by the side of the carotid artery, behind the internal jugular vein, and in company with the great sympathetic nerve.

What are the first branches which the par vagum gives off? — First, a branch to the glosso-pharyngeal; second, the pharyngeal to the pharynx; thirdly, the laryngeal to the larynx and thyroid gland; fourthly, branches to the cardiac plexus, and others of communication with the great sympathetic, the recurrent, and ninth pair.

How does the par vagum enter the thorax? — Passing before the subclavian artery and vein on the right side; but on the left, behind the subclavian vein, and before the arch of the aorta; and then gives off the recurrent.

What is the course and distribution of the recurrent nerve? — It forms a kind of loop, which embraces the subclavian artery on the right side and aorta on the left; it then runs behind these vessels, ascending to the posterior part of the larynx to be distributed to its muscles, and communicates with the great sympathetic, the cardiac plexus, &c.

What is the course and distribution of the rest of the par vagum?—It gives branches which go to the heart, and form the cardiac plexus; branches to the lungs, forming the pulmonary plexus, which then pass to the œsophagus, descend behind it to the stomach, forming the œsophageal plexus; and are especially distributed to the stomach, forming the coronary plexus.

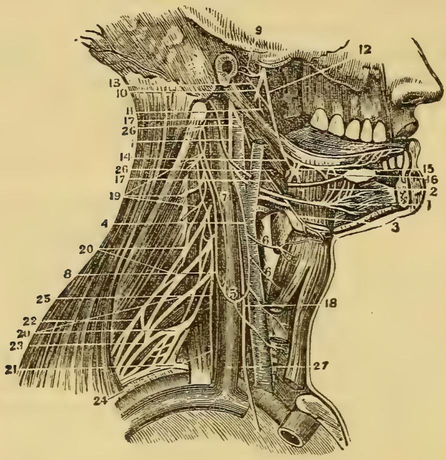
NINTH PAIR.

Where do the lingual nerves arise?[9] (Fig. 95, *supra.*) — Between the corpora pyramidalia and olivaria, by several filaments, which, uniting, form two small chords.

How do they pass out of the cranium, and what is their course and distribution?[1] (Fig. 100.)—They pierce the dura mater, and pass out by the anterior condyloid foramen, course along the large ganglion of

the great sympathetic before the jugular vein and carotid artery, and are distributed to the tongue.

Fig. 100.



To what nerves do they adhere on their exit from the cranium? — After quitting the cranium, each is united to the trunk of the eighth pair, to the superior cervical ganglion, and by a branch of communication to the tenth pair.

What branches do they give off in their passage toward the tongue? — Shortly after their exit from the cranium they give off a large branch, which descends along with the carotid artery, called descendens noni.[4]

How is the descendens noni distributed? — It joins branches from the first, second,[7] and third cervical,[8] and is distributed to the muscles at the fore part of the neck.

TENTH PAIR.

Where do the sub-occipital nerves arise?[1] — They arise at the extremity of the medulla oblongata and beginning of the spinal marrow, by small filaments.

How do they make their exit from the cranium, and what branches are given off? — They pass directly outward, and emerge under the edge of the occipital foramen, and send branches of communication to the eighth and ninth pairs, to the superior cervical ganglion, and to the first cervical pair; and are then distributed to the extensor muscles of the head and neck.

What are the respiratory nerves?—The par vagum, the portio dura

of the face, the external thoracic, the phrenic, and the spinal accessory nerves.

What would be the effects of dividing or paralysing these nerves? —By dividing the portio dura, the motions of the muscles on the side of the head would be stopped. By dividing the recurrent branch of the par vagum, the voice would be destroyed; and if the laryngeal branch were divided, the simultaneous action of the muscles of the chest and glottis would be lost; by compressing the par vagum, difficulty of breathing would be produced; if the phrenic nerve should be divided, the diaphragm would be paralyzed; and if the spinal accessory were divided, the respiratory motion of the mastoid and trapezius muscles would be destroyed.

VERTEBRAL NERVES IN GENERAL.

How do the vertebral nerves arise from the medulla spinalis? — Each arises by two fasciculi of nervous filaments; one anterior, the other posterior.

How do they pass from the canal of the spine?—The two fasciculi uniting form a ganglion, perforate the dura mater, and pass through the lateral foramina of the vertebral column, and one branch goes forward and the other backward.

How many pairs are there of the vertebral nerves? — Thirty, viz.: seven cervical, twelve dorsal, five lumbar, and six sacral.

FIRST PAIR.

Where do the first pair of cervical nerves make their exit? — Between the first and second cervical vertebræ.

How is the anterior branch distributed? — It communicates with the superior cervical ganglion, and with the sub-occipital nerve it sends branches to join the descendens noni and the second cervical pair, and others to the muscles at the anterior part of the neck.

How is the posterior branch distributed? — To the muscles at the upper and back part of the neck.

SECOND PAIR.

Where do the second pair make their exit? — Between the second nd third cervical vertebræ.

How is the anterior branch distributed? — It communicates with the second and fourth cervical pairs, the great sympathetic, the descendens noni; and often concurs in the formation of the phrenic nerve

What is the distribution of the posterior branch? — It follows a nearly similar course to that of the first pair, with which it anastomoses, as well as with the portio dura of the seventh.

THIRD PAIR.

Where do the third pair pass out ? — Between the third and fourth cervical vertebræ.

How is the anterior branch distributed ? — It communicates with the great sympathetic, fifth cervical, and sends a large branch to the phrenic.

How is its posterior branch distributed ?—To the back of the neck, and with those already noticed forms a plexus of nerves, which supply the back of the neck and head.

DIAPHRAGMATIC NERVE.

How is the diaphragmatic or phrenic nerve formed ?—By branches from several of the cervical nerves; of these the most constant and largest is from the third cervical.

What is its course ? — It runs before the scalenus muscle, enters the thorax behind the anterior extremity of the clavicle; then receiving a filament from the first dorsal and communicating with the sympathetic, it passes obliquely before the subclavian artery, and on one side of the par vagum, near the origin of the recurrent; within the thorax it passes before the root of the lung, along the side of the pericardium, and, running backwards, enters the diaphragm.

In what does the course of the right diaphragmatic nerve differ from that of the left ?— It runs straighter, and lies more anteriorly; the left lies backward towards the aorta, then bending over the pericardium, where it covers the apex of the heart; and it is longer than the right.

How is it distributed ? — It terminates by numerous ramifications on the greater muscle of the diaphragm, and by some filaments on the lesser, where it communicates with the sympathetic, and contiguous abdominal plexuses.

FOURTH, FIFTH, SIXTH, AND SEVENTH PAIRS.

How do the last four pairs of cervical nerves pass to the neck ? — They pass from the spine between their respective vertebræ.

How are their posterior branches distributed ? — They are small, and distributed to the posterior part of the neck, and upper part of the back.

How are their anterior branches distributed ? — They send small branches of communication to the great sympathetic, a few to the neighbouring muscles, glands, &c., &c., and they then unite, and, together with the first dorsal, form the axillary plexus.

BRACHIAL NERVES.

What is the axillary plexus ? — The union of the four inferior cervical and first dorsal nerves

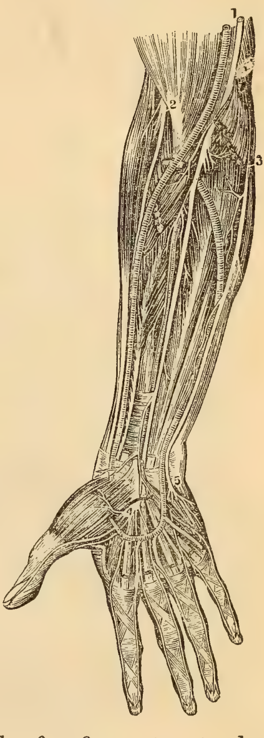
How is the axillary plexus constructed? — It consists at its origin of three distinct portions, viz.: a common trunk formed by the union of the fourth and fifth cervical; below, a common trunk formed by the union of the last cervical and first dorsal; and between these, the sixth cervical nerve alone: these soon unite and form a bundle of nerves so interwoven as not to be unravelled, which pass under the clavicle with the artery and vein into the axilla.

Whence do the brachial nerves arise? — From the axillary plexus.

What are the different branches of the brachial nerves? — The scapularis and the thoracic nerves are first given off; they then divide into six large nerves, viz.: the musculo-cutaneous, the median, the cubital, the internal cutaneous, the radial, and the axillary.

From what part of the great plexus do the brachial nerves arise? — The musculo-cutaneous, median, cubital, and internal cutaneous arise anteriorly; the radial and axillary posteriorly.

Fig. 101.



Where does the scapular nerve arise? — From the upper and back part of the plexus.

What is its course and distribution? — It runs to the coracoid notch, and is distributed to the supra and infra-spinatus, and teres minor.

Where do the thoracic nerves arise? — There are three in number, and arise from the upper part of the plexus.

How are they distributed? — To the pectoralis major and minor, serratus major anticus, and latissimus dorsi.

What is the course and distribution of the musculo-cutaneous nerve? — It passes through the substance of the coraco brachialis, then between the biceps and brachialis; to these it gives branches, and is distributed to the skin at the outer part of the forearm and back of the hand.

What is the course and distribution of the median nerve?[1] (Fig. 101.) — It is the largest nerve from the axillary plexus; and accompanies the brachial artery: in the forearm it passes deep-seated, between the flexor sublimis and profundus, under the ligamentum annulare carpi, to the palm of the hand, where it divides into branches, viz.: two to the thumb, two to the fore-finger, two to the middle finger, and one to the ring finger, after communicating with a branch of the cubital.

What is the course and distribution of the ulnar nerve?[3] — It descends along the inner part of the arm, passes in a groove between the inner condyle of the humerus and the olecranon, perforates the flexor carpi ulnaris, descends over the ligamentum annulare carpi to the palm of the hand, where it sends off one branch to the ring finger, two to the little finger, and a branch of communication to the median nerve.

What is the course and distribution of the internal cutaneous nerve? — It is the smallest of the brachial nerves; it passes superficially along the inside of the arm, and is distributed to the teguments at the inner and forepart of the forearm.

What is the course and distribution of the radial nerve?[2] —It runs backward round the os humeri, covered by the triceps, and gives branches to the outside of the elbow; at the bend of the arm it descends between the brachialis and supinator longus, to which and to the contiguous extensors and supinators it gives rami; it here divides into a superficial, and a profound branch; the superficial branch accompanies the radial artery; and at the lower part of the radius it sends rami to the convex part of the thumb and three adjacent fingers; the profound branch passes between the upper extremity of the radius and supinator brevis, in its passage supplying the neighbouring muscles; it is then lost in the extensor communis and muscles of the carpus and thumb, after having given a ramus to the musculo-cutaneous nerve.

What is the course and distribution of the axillary nerve? — It runs in the axilla, between the teres major and minor, and behind the head of the os humeri, round the neck of which it turns, passing between the articulation and the upper end of the long head of the triceps to the deltoid, under which it passes and ramifies, supplying the adjacent muscles and the joints.

DORSAL NERVES.

Of how many pairs do the dorsal nerves consist? — There are twelve pairs of dorsal nerves.

How do they pass from the vertebral canal.—The same as the cervical.

How do they resemble each other? — Each presents a gangliform enlargement, from which a small posterior branch and a large anterior branch arise.

How are the posterior branches distributed? — To the muscles and integuments of the back.

How are the anterior branches distributed? —They each send two branches to the thoracic ganglia of the great sympathetic; then follow the course and distribution of the intercostal arteries, and are called the intercostal nerves.

To the formation of what nerves do the first dorsal pair contribute?

—After communicating with the great sympathetic and sending off its posterior and a small intercostal branch, it concurs in the formation of the axillary plexus.

How are the humeral nerves formed? — The second and third intercostals send branches to form the humeral nerves, which pass into the axilla, and are distributed to the integuments on the inside of the arm.

How are the lower five dorsal nerves distributed? — They supply the muscles and integuments of the abdomen.

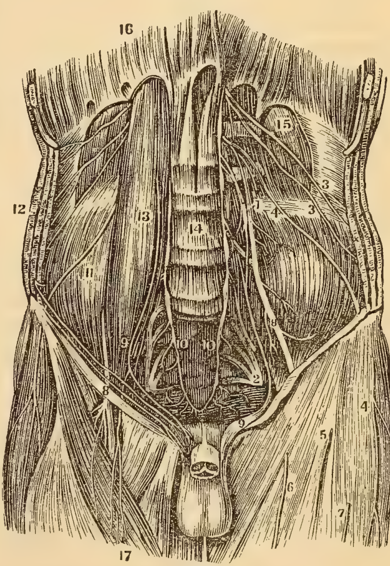
LUMBAR AND SACRAL NERVES.

Of how many pairs do the lumbar nerves consist? — Of five.

What is their general course and distribution? — They form each a ganglion after leaving the spine, and send off an anterior and a posterior branch in the same manner as the cervical and dorsal nerves; they send branches backward to the vertebral muscles, communicate with each other and with the sympathetic; and by their mutual communication they form the lumbar plexus.

What is the course and distribution of the first lumbar pair?[3] (Fig. 102.) — The first pair is distributed in three branches; one to the abdominal muscles, around the crista of the ilium; the other passes to the pubis and scrotum, and the third to the groin, where it contributes to form a crural nerve.[8]

Fig. 102.



What is the course and distribution of the second pair? — They contribute largely to the lumbar plexus,[1] and concur in the formation of the crural[9] and obturator nerves.

What is the distribution of the third pair? — They contribute to form the crural and obturator nerves, and give branches to the neighbouring muscles.

What is the distribution of the fourth pair? — It sends a branch which, joining one from the third and one from the second pair, forms the obturator; at the same place it completes the

formation of the crural nerve; its remaining portions join the fifth pair.

What is the course and distribution of the fifth pair? — It descends on the sacro-iliac symphysis, enters the pelvis, and receiving a branch from the fourth lumbar, joins the sacral nerves to produce the sciatic plexus.[2]

What is the origin of the obturator nerve? — By branches from the second, third, and fourth pairs of lumbar nerves.

What is its course and distribution? — It passes from the pelvis at the upper part of the obturator foramen, supplying in its course the obturator muscles and pectineus; it then divides into three chief branches to the portions of the triceps, and sends rami between them to the gracilis.

Of how many pairs do the sacral nerves consist? — There are generally six pairs.

How are they distributed? — Their posterior small branches pass out by the posterior sacral foramina; the anterior branches of the four superior pass through the anterior sacral foramina; the two inferior through the lateral notches at the extremity of that bone, and in the coccygis.

Which of them form the sciatic plexus? — The three superior, by their junction with the fourth and fifth lumbar pairs.

What are the branches proceeding from the sciatic plexus? — From the plexus, but more especially from the second pair, a branch goes to the vesiculæ seminales, prostate gland, uterus, and fallopian tubes; another, chiefly from the fourth pair, has a similar distribution, and goes also to the rectum and bladder; a third branch, the pudic, chiefly from the third, runs on the inside of the ischium to the corpus cavernosum, the muscles, parts of generation, and sphincter ani; from the extremity of the plexus, one branch, the glutæal, goes to the glutæus medius and minimus.

How are the last two pairs of sacral nerves distributed? — The fifth pair, running forward between the extremity of the sacrum and ligament of the os coccygis, is distributed chiefly to the muscles of the anus and neighboring integuments; the last pair, running in a direct line from the extremity of the sacral canal, is distributed to the anus integuments, &c.

CRURAL AND SCIATIC NERVES.

How is the crural nerve formed? — By the union of the three or four superior lumbar nerves.

How does it pass out of the abdomen? — Under Poupart's ligament.

How is it situated with regard to the femoral artery and vein? — Anteriorly.

What is its course and distribution? — In the groin it divides into

numerous branches; some superficial, which go to the integuments; others profound, which are distributed to the neighboring muscles; one branch, longer and larger than the rest, accompanies the saphena vein to the ankle, and in its course on the thigh, accompanies the femoral artery.

How is the great sciatic nerve formed?—It is the largest nerve in the human body, and is formed by the plexiform union of the last lumbar and first four sacral pairs.

How does it pass out of the pelvis, and what is its course and branches?—It passes out by the great ischiatic notch, proceeds betwixt the great trochanter and tuberosity of the ischium, descends on the back part of the thigh to the ham, where it receives the name of popliteal nerve, and gives branches to the muscles and integuments in its passage to the ham.

What is the situation, course, and distribution of the popliteal nerve?—It is situated between the hamstrings, and divides into an external or fibular nerve, and an internal or tibial nerve, which gradually separate and passes behind the condyles of the os femoris, and between the heads of the gastrocnemii muscles.

What is the course of the tibial nerve?—It descends behind the popliteal muscle, between the gastrocnemii; it then pierces the head of the soleus, and runs between that muscle and the great flexors of the toes, near to the inner ankle.

What is its distribution?—It sends rami to the joint of the knee, the muscles and integuments contiguous to its course; it sends also branches to the tibialis posticus, to the upper part of the tibialis anticus muscle; it then sends a long ramus down the back of the leg, between the integuments and gastrocnemius, by the side of the saphena externa; the trunk then passes behind the inner ankle through an angular ligament to the sole of the foot, where it divides into the external and internal plantar nerves, which accompany the arteries of the same name.

What is the course and distribution of the internal plantar nerve?—It runs first along the inner side of the sole of the foot, giving filaments to the abductor pollicis, flexor brevis digitorum, and massa carnea sylvii; it then divides into four branches, distributed to the toes after the manner of the median nerve in the hand.

What is the course and distribution of the external plantar nerve?—It passes along the outer edge of the foot, and divides into two branches; the first branch runs between the two last toes, and divides to their sides; the second branch goes to the inferior external side of the little toe.

What is the course and distribution of the fibular nerve?—It runs forward round the head of the fibula, and divides into several rami, which are distributed to the outer part of the leg, and to the upper part of the foot, where it is distributed to the integuments.

SYMPATHETIC NERVES.

Describe the sympathetic nerves.—This system consists of a series of ganglia on each side of the spinal column, from the head to the coccyx, connected with other nerves of the body, and distributing branches to the internal organs and viscera. It communicates with the other nerves at their exit from the cranium and vertebral canal, excepting the fourth and sixth, where it communicates in the cavernous sinus also with the olfactory, optic, and auditory, at their ultimate expansions.

How are they distributed?—They accompany the arteries, and take their names from them, and communicate around them, forming *plexuses.* The internal organs of the head, neck, and trunk, are supplied more exclusively with branches from this nerve, and hence it is considered the nerve of organic life. It has also been called the ganglionic nerve.

How many sympathetic ganglia are there in the head?—Five. The ganglion of Ribes (now doubted), the superior point of union between the chain of nerve in the two sides of the body; it is located upon the anterior communicating artery, and by filaments connected with the carotid plexus, and other ganglia of the sympathetic. The ciliary or lenticular, situated in the orbit between the optic nerve and external rectus muscle; its distribution is by the ciliary branches, which accompany the ciliary arteries, and send filaments to the tunics of the eye-ball, piercing the sclerotic coat; it communicates also sometimes with the spheno-palatine ganglia. Its communicating branches are the long root to the nasal branch of the ophthalmic nerve; a short root to the inferior division of the third nerve; the sympathetic root, which passes back to the cavernous sinus, and communicates with the carotid plexus. The spheno-palatine, or ganglion of Meckel, situated in the spheno-maxillary fissure, is distributed by the internal branches, the *nasal*, or *spheno-palatine*, to the mucous membrane of the nose, and also by small perforating branches to the upper part of the pharynx and Eustachian tube; the naso-palatine (scarpa), after giving filaments to the septum of the nares, curves down, enters the anterior palatine canal, connects with its opposite fellow, receives branches from the anterior dental and palatine nerves, and together form the naso-palatine, or Cloquet's ganglion, which sends filaments to the mucous membrane of the palate, and behind the incisor teeth. The descending branches, viz.: the anterior palatine, descending through the posterior palatine canal, emerges at the posterior palatine foramen, is distributed in the substance of the hard palate, communicating with the naso-palatine ganglion and branches; in the posterior palatine canal several branches perforate the palate bones, and are distributed to the middle and inferior meatus, the inferior spongy bones, and antrum; the middle one has the same course as the preceding, and supplies the tonsil, soft palate, and uvula; the posterior

one leaves the others, by a distinct canal, and by a separate opening back of the posterior palatine foramen, supplies the hard palate, gums, tonsils, and soft palate.

What are its branches of communication?—The ascending, to join the superior maxillary nerve, one to the abducens nerve, one to the ciliary ganglion, and sometimes to the optic nerve; the posterior, or *vidian nerve*, passes back from the spheno-palatine ganglion, through the vidian canal, to the foramen lacerum, at the base of the cranium, and divides into the carotid, which enters the carotid canal to join the carotid plexus; the petrosal enters the cranium as the preceding, and passing backward to the hiatus fallopii, receives a twig from Jacobson's nerve, and terminates in the intumescentia gangliformis of the facial nerve; it also communicates with the *otic* ganglion.

Describe the otic ganglion (Arnold's).—It is small and flattened, resting upon the inner surface of the inferior maxillary nerve, at the union with the motor root, below the foramen ovale; internally it rests against the cartilage of the Eustachian tube, and tensor palati muscle, posterior with the anterior meningea media.

What are its branches?—Those of distribution to the tensor tympani and to the tensor palati muscles; those of communication to the inferior maxillary, the auricular, chorda tympani, to the arteria meningea media, to communicate with the *nervi mollis*, to the hiatus fallopii, the intumescentia gangliformis, to the casserian ganglion, to the vidian nerve, which is there again distributed.

Describe the submaxillary ganglion.—It is small and round, lying upon the submaxillary gland, near the gustatory nerve; it is distributed to the gland and Wharton's duct; it has communicating branches to and from the gustatory nerve, from the chorda tympani to the facial nerve, communicating with the nervi mollis.

Describe more particularly the carotid and cavernous plexus.—The carotid plexus is formed by the branches of the superior cervical ganglion dividing into two parts, and form communications with each other around the carotid artery in the carotid canal, which, together with the branches of the petrosal branch of the vidian nerve, forms this plexus. The cavernous plexus is in the cavernous sinus, and is rather a continuation of the previous plexus, and after giving branches on the carotid artery, communicates with the third, fourth, and fifth cranial nerves, which enter the orbit.

How is the inferior cervical ganglion connected inferiorly?—Into a chord of communication with the middle, or, if it is wanting, with the inferior cervical ganglion.

What are the arterial visceral branches of the superior cervical ganglion?—The delicate gray nerves (or nervi mollis of Scarpa), together with the glosso-pharyngeal and vagus, form a plexus round the internal, external, and common carotids. The pharyngeal branches, together with filaments from the glosso-pharyngeal and vagus, form the pharyngeal plexus. The laryngeal branches, accompanying the

superior laryngeal branches of the vagus. A cardiac nerve, not always present, either united with a similar nerve from the middle or inferior cervical ganglion, or alone, passes with the carotid artery to the chest, and assists in forming the plexus belonging to the heart.

Where is the middle cervical ganglion situated, and what is its distribution?—This is not always present; when found, it is situated opposite the fifth and sixth cervical vertebræ, and upon the inferior thyroid artery; it has branches of continuation with the third, fourth, and fifth cervical nerves, and gives off the middle cardiac nerve; it then has a course like the inferior, but is often absent, and is then supplied by filaments from the superior nerve or vagus.

Describe the cardiac nerves.—There are three: the superior, middle and inferior. The first arises from the superior cervical ganglion, descends the neck, runs by the side of the recurrent laryngeal, passes behind the arteria innominata, receiving branches from the pneumogastric, and giving filaments to the thyroid gland, and at the concavity of the aortic arch, joins the cardiac ganglion. The second either proceeds from the middle cardiac ganglion or from the communicating end, between the superior and inferior, being the largest. After dividing into several branches at the root of the neck, it communicates with the superior and inferior, and pneumogastric and recurrent, and descends to the *great cardiac plexus*. The third arises from the inferior cervical ganglion, communicates with the recurrent laryngeal and middle cardiac nerves, and in front of the trachea, joins the *great cardiac plexus.*

Where is the cardiac ganglion situated, and what does it receive and give off?—Beneath the arch of the aorta, to the right of the ligament of the ductus arteriosus, receiving the superior cardiac nerves from both sides of the neck, and a branch from the pneumogastric, and sends branches to the cardiac plexuses.

Where is the cardiac plexus situated and how is it divided, and what does it supply?—It is divided into the *great*, the *interior*, and *posterior*. The great is situated upon the bifurcation of the trachea, and behind the arch of the aorta, and is formed by the convergence of the middle and inferior cardiac nerves, and branches from the pneumogastric and descendens noni and first thoracic ganglion. The anterior is situated in front of the ascending aorta, near its origin, and is formed by filaments from the superior cardiac, the cardiac ganglion and the great cardiac plexus. It supplies the anterior aspect of the heart, and by numerous filaments, forming the *anterior coronary plexus.* The posterior, formed by branches from the great cardiac plexus, is situated the reverse of the preceding, dividing into two sets of branches, which constitute the *posterior coronary plexus.*

Describe the thoracic ganglia and the branches they give off.—They are generally twelve in number on each side, and rest upon the heads of the ribs, covered by the pleura costalis, and are divisible into superior, inferior, external, and internal branches; the superior branch

communicates with the one above, and the inferior with the one below; the external branches communicate with the roots of the spinal nerves; the internal branches communicate with the œsophageal, and aortic nerves and branches. The first cardiac plexus is also supplied by the first thoracic ganglion, and the branches of the lower ganglia are aortic, and by several large cords uniting, form the splanchnic nerves.

Where is the greater splanchnic nerve?—It arises from the sixth dorsal ganglion, and is increased by branches from the seventh, eighth, ninth and tenth, and descending in front of the vertebræ, pierces the diaphragm, and terminates in the *semilunar ganglion.*

Where is the lesser splanchnic or renal nerve?—It is formed by filaments from the tenth, eleventh and twelfth dorsal ganglion, and after piercing the diaphragm, goes to form the renal plexus.

Where is the semilunar ganglion situated?—By the side of the cœliac axis, communicating with the opposite ganglion, above and below that trunk, forming a gangliform circle, which gives off branches called the solar plexus.

What nerves and branches does the solar plexus receive and give off?—The great splanchnic and part of the lesser. The termination of the right pneumogastric branches from the right phrenic, and sometimes from the left. It distributes filaments to the phrenic, gastric, hepatic, splenic, supra renal, renal, which is formed chiefly by the lesser splanchnic; superior mesenteric, spermatic, formed chiefly from the renal, and inferior mesenteric plexus, which also receives filaments from the aortic plexus.

LUMBAR GANGLIA.

How many lumbar ganglia are there?—Four on each side, upon the anterior face of the lumbar vertebræ.

How are the branches divided?—Into the superior and inferior, which are those of communication, as in the dorsal; the external communicating with the lumbar nerves, the internal divided in two sets, the upper of which pass in to form the lumbar aortic plexus, the lower to form the hypogastric plexus, by crossing the common iliac arteries and uniting over the promontory of the sacrum.

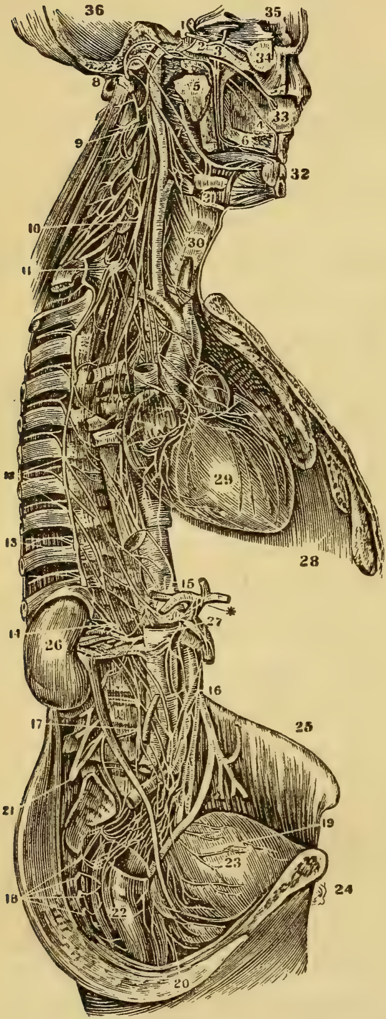
From what does the lumbar aortic plexus receive branches and send filaments?—From the solar and superior mesenteric plexuses, and sends filaments to the inferior mesenteric, and ends in the hypogastric plexus.

How is the hypogastric plexus formed, and where is it situated?—By the termination of the aortic plexus, and by the union of the branches of the lower lumbar ganglia, it is situated as mentioned before, and communicates with the fourth and fifth sacral nerves, and is distributed to the pelvic viscera; and filaments accompany the internal iliac artery.

SACRAL GANGLIA.

How many are there, and where situated? — There are four or five upon the sacrum, and resemble the lumbar in form and connection. The external branches communicate with the sacral nerves, and the internal branches communicate with the lateral divisions of the hypogastric plexus, and are distributed as it is; the last pair by branches, join a ganglion on the first line of the coccyx, called *ganglia impar* or *azygos*, which gives branches to the coccyx and rectum, and plays a similar part as the ganglion of Ribes in the head, by forming a connecting point.

Fig. 103.



[To assist the student we have added the adjoining cut, and general account of this nerve in a succinct form.]

How are the ganglia of the sympathetic divided? (Fig. 103.) — They are divided into cervical, dorsal, lumbar, and sacral.

How many cervical ganglia are there? — There are three, viz.: a superior, a middle, and an inferior.

Where is the inferior cervical ganglion situated? — Behind the vertebral artery, at the root of the transverse process of the last cervical vertebra.

What branches does it give and receive? — It receives branches from the three inferior cervical and first dorsal pair, and from the recurrent; and sends off branches to the cardiac and pulmonary plexuses.

Where does the great sympathetic form the first dorsal ganglion?—Immediately below the inferior cervical and behind the subclavian artery.

How are the inferior cervical and first dorsal ganglia connected?—By a short portion of the trunk, which is sometimes double and plexiform, and by a branch which passes before the subclavian artery; thus forming an arch which encloses the body.

SENSES.

NOSE.

How is this divided? — Into an external prominent part and internal cavity.

What are the external parts? — The root, arch, tip, alæ, and nostrils.

What are the internal parts? — The septum, turbinated bones, posterior openings of the nares, the frontal, maxillary, and sphenoidal sinuses, palatine duct, and ductus ad nasum.

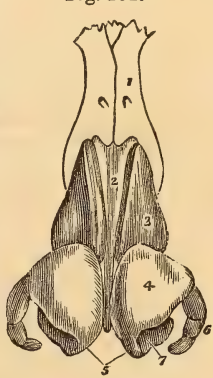
What bones form the nose? — The os frontis, os æthmoides, sphenoides, ossa maxillaria superiora, ossa nasi, ossa lachrymalia, ossa palati, vomer, inferior turbinated bones and cartilages.

What are the soft parts of the nose? — The integuments, muscles, pituitary membrane, vessels, nerves, and hairs.

How is the root and arch formed? — By the nasal processes of the superior maxillare, and the nasal bones.

Of how many cartilages does the inferior part of the external nose consist, and what is their situation? (Fig. 104.) — Of five, the middle one[2] is part of the septum nasi, and divides the nostrils; two anteriorly[3] from the tip, and two laterally the alæ.[4]

Fig. 104.



What is the form and extent of the cavities of the nose?—Antero-posteriorly from the nostrils to the posterior openings of the nares, immediately above the arch of the palate. They are bounded on the inner side by the septum, and on the outer side by the maxillary, lachrymal, æthmoid, and turbinated bones.

How are the internal nares lined, and what are their use? — By the pituitary membrane; and serves for the expansion of the olfactory and other nerves, for the transmission of vessels, and the secretion of the fluid which moistens its surface.

What sinuses open into the internal nares, and where do they open? — The frontal, sphenoidal, and maxillary sinuses. The frontal

opens into the anterior superior part of the nares, the sphenoidal into the superior posterior part of the nares, and the maxillary laterally above the inferior turbinated bones.

Where are the ducti incisivi situated? — Behind the large superior dentes incisivi, between the arch of the palate and the bottom of the nares.

What are their use? — They transmit several twigs of arteries and veins, and sometimes are perforated by ducts.

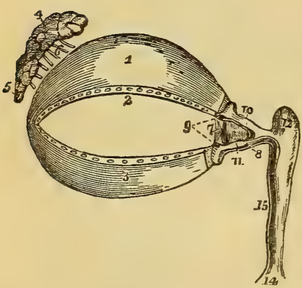
Whence is the nose supplied with blood? — From the external carotids; and the veins go to the external jugular.

What are the nerves of the nose? — The olfactory are the chief nerves of the nose, or the nerves of smelling; and the nerves of common sensation are from the fifth pair.

EYES AND APPENDAGES.

Where are the eyes situated? (Fig. 105.) — In the orbits, surrounded by muscles, and an apparatus for tears; these parts are called the appendages of the eye.

Fig. 105.



Where and what are the orbits? — Two conical, or tunnel-like cavities situated on each side of the nose, just below the forehead.

What are the names of the bones which compose the orbit? — The os frontis, os sphenoides, os æthmoides, os maxillare superius, os malæ, os lachrymale, and os palati.

By what foramina is each orbit perforated, and where are they situated? — By the optic foramen at its apex; by the sphenoidal fissure at the upper part of the external side; by the spheno-maxillary fissure at the lower part of the external side.

Whence is the lining membrane of the orbit derived? — From the dura mater, and periosteum.

Describe the supercilia, or eye-brows. — They are situated upon the superciliary ridge, formed by integuments, covered by two arches of coarse hairs, which protect the eye, and assist in varying the expression of the countenance. They are moved by the occipito-frontalis orbiculares and corrugatores supercilii muscles.

Describe the eye-lids, or palpebræ. — They are two thin movable folds placed in front of the eye, to conceal and protect it, with a muscle in the upper lid exclusively for its elevation (levator palpebræ superioris); the two lids are joined at the outer and inner angles, called *canthi.* The lids, when in contact, have a triangular canal passing transversely between them.

Of what are they composed? — Of common integuments. Of the

orbicularis palpebrarum muscle, the tarsi cartilages which contain the ciliary glands, and the cilia or eye-lashes.

Describe the tarsi.[1]—These are the cartilages at the edge and in the body of each lid. They are semilunar in shape, and attached to the external and internal palpebral ligaments.

Which of the edges of the tarsi are the thickest?—The ciliary, which are turned towards each other,

What is formed by the meeting of the ciliary edges?—A small groove, which conducts the tears to the inner canthus.

What is the appearance of their inner sides?—They are grooved for the reception of the ciliary glands.

Describe the ciliary or meibomian glands.[2]—These are twenty or thirty, situated on the inner side of the tarsi, and at the edges of which discharge an unctuous matter to lubricate the edges of the eyelids. They resemble numerous white lines on the edges of the lids.

Describe the cilia or eyelashes.—They are rows of pencil-like hairs upon the edges of the eyelids, and diverge on the opposite lids, and diminish in size from the middle to the ends of the lids.

What parts compose the lachrymal apparatus?—It is composed of the lachrymal gland, the caruncula lachrymalis, plica semilunaris,[7] puncta lachrymalis;[9] canaliculi lachrymales, lachrymal sac, and ductus ad nasum.

Where is the lachrymal gland[4] situated?—In the depression behind and somewhat above the external angular process of the frontal bone.

What is its form?—It is somewhat flattened, and divided into two lobes, orbital, and palpebral.

What is the course of its ducts?[6]—It has several excretory ducts, which descend almost parallel to each other through the substance of the membrane which lines the upper eyelid, and pierce it near the superior edge of the tarsus.

What is the caruncula lachrymalis?[8]—A little red eminence situated behind the internal angle of the eyelids and the ball of the eye, and of a glandular structure.

What is its use?—It secretes a yellowish oily matter, with which the hairs on its surface, being coated, detain any small bodies that float in the tears; it also directs and assists the tears in their course.

Where is the lachus lachrymalis, and what is its use?—It is a depression between the caruncula lachrymalis, the eyelids, and eyeball It collects the tears to pass into the puncta lachrymalia.

Where is the plica semilunaris,[7] and what is its form?—It is situated between the caruncula lachrymalis and the ball of the eye, and resembles the figure of a crescent.

What is the direction of its cornua?—They are turned toward the puncta lachrymalia.

What is its use?—To direct the tears toward the puncta.

What are the puncta lachrymalia?[9]—Two small orifices situated one

on the edge of each eyelid, very near the inner angles, opposite to the cornua of the plica semilunaris, and precisely opposite to each other.

How are they formed? — A minute cartilaginous circle surrounds them, and a fine membrane lines their orifices.

What is their use?—To suck up the tears, and convey them to the lachrymal ducts.

What are the canaliculi lachrymales? — Two minute canals, sometimes called lachrymal ducts, one for each eyelid.

What is their situation?—Between the puncta lachrymalia and the lachrymal sac.

What is their direction? — The superior first ascends, then gradually descends; the inferior first descends, then gradually ascends; they then meet and form a common tube, which opens into the lachrymal sac.

Where is the lachrymal sac[12] situated? — Immediately below the inner canthus of the orbit, in a bony groove, or fossa, on the side of the upper part of the nose.

How is this groove formed? — By the nasal process of the superior maxillary and lachrymal bones superiorly; and by the os maxillare, lower part of the os lachrymale, and upper portion of the inferior turbinated bone inferiorly.

What is the form of the lachrymal sac? — It is an oblong membranous bag.

Where is the lachrymal sac crossed by the tendon of the orbicularis palpebrarum? — About one-fourth of its edge is above the tendon of the orbicularis palpebrarum, and the rest below it.

Where do the lachrymal ducts open? — Immediately behind the tendon of the orbicularis.

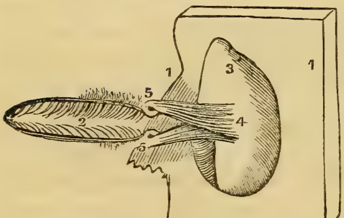
Where does the ductus ad nasum commence?—From its lower part.

Where is the ductus ad nasum situated?[15] — It descends from the lachrymal sac into the nose in a bony groove.

How is this groove formed? — By the inferior part of the os lachrymale, and superior part of the inferior turbinated bone.

Where does the ductus ad nasum terminate? — Underneath and behind the anterior extremity of the inferior turbinated bone.

Fig. 106.



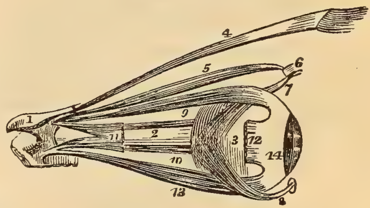
Where is the tensor tarsi or Horner's muscle? (Fig. 106.)–It arises from the os unguis, and is inserted by two divisions into the orifices of the lachrymal canal, it adheres by its nasal face to the lachrymal sac.

What is the course of the tears? —They are secreted by the lachrymal gland, and are poured, by its excretory ducts, over the anterior surface of the eye, which, in the movements of the eyelids, they everywhere moisten; the puncta

lachrymalia absorb them; they are conveyed by the lachrymal ducts to the lachrymal sac, and through the ductus ad nasum they pass into the nose.

What is the origin, insertion, and use of the levator palpebræ superioris?[4] (Fig. 107.)—Origin: upper edge of foramen opticum. Insertion: superior border of tarsal cartilage, and is inserted into the superior palpebral sinus of conjunctiva behind palpebral ligament. Use: to raise the upper lid by drawing it to the bottom of the orbit.

Fig. 107.



Of the rectus superior,[9] rectus inferior,[13] rectus internus,[10] and rectus externus?[11] — They all arise from the optic foramen, and are inserted in the sclerotiea behind the cornea, a quarter of an inch. The superior raises the eye; the inferior depresses it; the internus turns it in, and the externus turns it out.

Of the obliquus superior?[5] — Origin: on the inner side of the levator. Insertion: sclerotic coat between the superior and external recti. It draws the eyeball forwards and towards the internal canthus, and directs the pupil towards the cheek.

Of the obliquus inferior?[8] —Origin: orbital edge of superior maxillary bone above infra-orbital foramen. Insertion: sclerotic coat behind the transverse axis of the eye, and between the sclerotic coat and external rectus. Use: to cause the eye to revolve on its axis, and turns the cornea towards the nose.

GLOBE AND COATS OF THE EYE.

What is the form of the globe of the eye? (Fig. 108.) Nearly of a spherical figure.

Of what is the globe of the eye composed? — Of membranes, or coats, filled with humors or fluids, which support its form.

How many coats has the eye? — Seven, viz.: the tunica conjunctiva, tunica sclerotica, cornea, tunica choroides, iris, retina, and tunica jacobi.

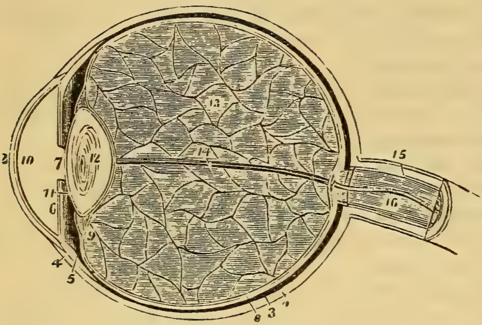
What is the tunica conjunctiva?—A very thin transparent mucous membrane, which connects the eyelids to the globe of the eye, forming a fold, *plica semilunaris*, at the inner canthus, which may be considered as common to both.

What is its situation, and how is it divided? — It covers the anterior part of the ball of the eye, and the inner side of the eyelids, and is divided into the conjunctiva palpebrarum, and the conjunctiva oculi.

How is it connected to the ball of the eye? — By cellular membrane, and adheres most closely over the cornea. It is highly vascular and nervous.

Where is the tunica sclerotica situated? — It is the most external, and by far the most dense coat of the eye; it envelopes all the ball of the eye, except the portion anteriorly occupied by the cornea; and posteriorly it is pierced by the optic nerve; there are numerous foramina in it for bloodvessels and nerves.

Fig. 108.



A longitudinal Section of the Globe of the Eye.—1. The Sclerotic Coat. 2. The Cornea. 3. The Choroid Coat. 4. The Ciliary Ligament. 5. The Ciliary Processes. 6. The Iris. 7. The Pupil. 8. The Retina. 9. The Canal of Petit, which encircles the Lens. 10. The anterior Chamber of the Eye, containing the Aqueous Humor. 11. The posterior Chamber. 12. The Lens enclosed in its proper capsule. 13. The Vitreous Humor enclosed in the Hyaloid Membrane. 14. A Tubular Sheath of the Hyaloid Membrane. 15. The Neurilemma of the Optic Nerve. 16. The Arteria Centralis Retinæ.

What is its structure?—Fibrous.

Where are the muscles that move the eyeball attached to this coat? — Towards its anterior part.

What is the use of the sclerotica? — It bounds the form of the eye, and protects and supports the parts which it contains.

What is the cornea? — The transparent anterior part of the globe of the eye, and is firmly connected to the edge of the sclerotica, and appears like a watch-glass fixed in the edge of the case.

What is its form and situation? — Circular and more convex than the rest of the ball; and is divided into several lamella, between which a transparent fluid is noticed.

What is the use of the cornea?—It collects and bends inwards the rays of light reflected from surrounding objects.

What and where is the canal of Fontana? — It is a venous sinus near the border of the cornea.

Describe the choroid coat.— It is the most vascular coat of the eye, between the sclerotica and retina, extending from the point where it is pierced by the optic nerve to the ciliary ligament and fore part of the hyaloid membrane, where it is thrown into folds round the margin of the crystalline lens, forming the ciliary body by contact with the ciliary ligament, from which short folds proceed, called *ciliary processes*, encircling the lens.

What is the ciliary ligament, or annulus albidus? — A flat circular narrow band of greyish-white substance under the fore part of the sclerotica just behind its junction with the cornea, and unites the external border of the iris and ciliary body.

What is the pigmentum nigrum? — A black or dark brown secre-

tion covered by and contained in a membrane, which covers the internal surface of the choroid coat.

Describe the ciliary muscle. — It is a small structure behind the ciliary ligament, and covering the outside of the ciliary processes.

What are the blood-vessels of this coat of the eye? — The ciliary arteries, after piercing the sclerotica, ramify copiously in this membrane; its veins take a contorted course, and are called vasa vorticosa.

What is the iris, and where is it situated? — It is a circular membrane, with an opening through its centre, forming an imperfect septum across the cavity of the eye; and it is attached to the ciliary ligament in its whole circumference.

What is the hole in its middle called? — The pupil, which is lessened or augmented by the movements of the iris.

What name has been given to the posterior side of the iris? — It has been called uvea.

What is the structure of the iris? — It is supposed to consist of a radiated and circular layer of muscular fibres; its arteries, from the ciliary, form by anastomosis two circles,—one near the circumference, called zona major, the other near the pupil, called zona minor; its veins pass to the vasa vorticosa of the choroid; its nerves are from the ciliary.

What is the use of the iris? — By contracting, it excludes all superfluous rays of light, or by expanding, admits through the pupil all that pass through the cornea.

Where is the tunica jacobi situated? — Between the retina and choroid coat.

What is the situation of the retina? — Internal to the choroid coat.

Where does it arise? — From the termination of the optic nerve.

Where does it terminate anteriorly? — It extends anteriorly, terminating in a ruffled or serrated edge, nearly to the ciliary ligament.

Where does the optic nerve enter the ball of the eye? — On the inner side of its axis.

Where is the foramen and yellow spot of Sœmmering situated? — In the axis of the globe of the eye, about a line and a half from the outer edge of the bulb of the optic nerve.

What is the structure of the retina? — It is composed of an outer membrane, an inner vascular net-work, and an intermediate nervous stratum; in the living subject it is transparent, but becomes opaque by slight decomposition.

How is the retina supplied with blood? — By a small artery, which occupies the centre of the optic nerve, which also supplies the lens.

What is the use of the retina? — It perceives the picture formed upon its surface by the collection, refraction, and transmission of the rays of light.

HUMOURS OF THE EYE.

Of how many humours does the eye consist, and what are their names? — Of three transparent fluids of different densities; and are called the aqueous, the crystalline, and the vitreous humours.

What is the aqueous humour? — A perfectly transparent limpid fluid, situated behind the cornea and before the crystalline.

How are the chambers of the eye formed? — They are divided by the iris into two cavities, called chambers, which communicate through the pupil.

Which is the largest? — The anterior chamber.

What is the use of the aqueous humour? — It transmits the rays of light, and permits the free motions of the iris.

What is the vitreous humour, and where is it situated? — It is the most bulky humour of the eye; of a jelly-like consistence, yet quite transparent, and occupies all the ball of the eye behind the crystalline lens.

What is its form? — Spherical, except anteriorly, where it receives the crystalline lens.

By what is it enveloped? — By its peculiar capsule, called tunica vitrea, or hyaloidea, of the most delicate and transparent texture.

What is its internal structure? — It is divided by numerous septa proceeding from the inner surface of its capsule, into numerous cells.

What is the use of the vitreous humour? — It fills the membranes and supports the form of the eye, and maintains the crystalline lens at a proper distance from the retina.

What is the canal of Petit? — The space between the two laminæ of the hyaloid membrane, round the circumference of the lens.

What is the zona ciliaris, or zone of Zinn? — A dove-tailing arrangement upon the vitreous humour, with the ciliary processes.

Have any vessels or nerves been found in the vitreous humour? — No.

What is the use of the crystalline lens? — It is the main instrument for concentrating the rays of light so as to make a distinct image at the bottom of the eye.

Where is the crystalline lens? — It is situated in a concavity at the anterior part of the vitreous and behind the aqueous humour, opposite to the pupil.

What is its form? — It resembles a double convex lens or magnifying glass, and its posterior surface is more convex and larger than the anterior. In youth it is spherical; in advanced life it is flattened.

By what is it enveloped? — It has a proper capsule, which adheres firmly to the capsule of the vitreous humour, in which is the liquor morgagni.

What is its internal structure and general appearance? — It consists of concentric lamellæ, and these of radii; it is of the consistence of softened gum of a transparent, colourless appearance.

What is the use of the pigmentum nigrum? — It prevents the reflection of the rays of light when once they have reached the retina, and thus avoids confusion in vision.

VESSELS AND NERVES OF THE EYE.

Whence are the arteries of the eye derived? — Chiefly from the ophthalmic, a branch of the internal carotid.

Whence are the nerves derived? — Besides the optic, we have the third and fourth pairs, the ophthalmic or first branch of the fifth pair, the sixth pair, and twigs from the seventh pair go to the surrounding parts and form the ciliary plexus, whose branches pierce the sclerotica, and pass to the iris.

EAR.

How is the organ of hearing divided? — Into the external, middle or tympanum, and internal ear, or labyrinth.

Into what parts is the external ear divided?—Into three parts, viz.: the pinna, lobus, and meatus auditorius externus.

What is the situation and form of the pinna?—It forms the greater part of the outer ear, and is formed of cartilage, invested by common integuments.

What are its elevations? — The helix, anti-helix, tragus, and anti-tragus.

Where are these situated?—The helix is the external margin; the anti-helix is the inner margin; the tragus is the small anterior protuberance; the anti-tragus is the posterior protuberance, and opposite the tragus.

What are the depressions on the pinna, and where are they situated?—The fossa navicularis, in the bifurcation in the superior extremity of the anti-helix; the fossa innominata, between the anterior and superior extremities of the helix and anti-helix; the concha is the great cavity surrounded by the anti-helix.

What are the ligaments of the pinna?—A superior, an anterior, and a posterior.

What is the use of the pinna?—To collect the sonorous undulations of air, and reflect them to the meatus auditorius externus.

What is the situation of the lobe of the ear, and its structure? — At the inferior extremity of the external ear; and consists of skin and cellular substance.

What is the origin, insertion, and use of the helicis major and helicis minor? — The former is attached to the point of cartilage in front of the helix, and the other extremity extends to the top of the latter. The latter is on the front of the helix.

Where is the tragicus and the anti-tragicus?—The former is on the front surface of the tragus; the latter arises from the upper extremity of the anti-tragus, and is inserted into the inferior extremity of the anti-helix.

Where is the transversus auriculæ?—On the internal surface of the pinna, arising from the prominence of the concha, and inserted into the hollow dorsum and anti-helix.

What is the origin, insertion, and use of the attollens auriculæ?—Origin: cranial aponeurosis. Insertion: upper and anterior part of cartilage of ear. Use: to raise the pinna.

Of the retrahens auriculæ?—Origin: mastoid process. Insertion: back part of concha. Use: to draw the pinna backward.

Of the anterior auriculæ?—Origin: temporal fascia. Insertion: into the part of helix just above beginning. Use: to draw the pinna forward and upward.

Where is the meatus auditorius externus?—It extends from the bottom of the concha inward to the membrana tympani; then inward, forward, and upward; and is in the course a little curved downward; and is about an inch long.

How is the meatus externus formed?—It consists in part of cartilage continued from the pinna, and in part of bone.

Which of its portions is the longest?—In the adult the bony portion is the longest; but in the fœtus, the meatus auditorius is wholly cartilaginous.

What glands are situated in the cellular membrane and integuments lining the meatus externus?—It is lined by a continuation of the integuments of the concha, under which the ceruminous glands are placed, especially towards the concha, which secrete the cerumen or ear wax.

What is the use of the meatus auditorius externus?—It concentrates and conveys the sound to the membrana tympani.

Whence are the arteries of the external ear derived, and whence do the veins pass?—It receives its arteries anteriorly from the temporal, and posteriorly from the occipital arteries; and its veins pass to the external jugular.

Whence are its nerves derived?—From the tempora-auricular branch of the fifth nerve.

Where is the membrana tympani?—At the bottom of the meatus externus, forming the external side of the tympanum; it is fixed in a bony groove.

What is its direction and form?—It is of an oval form, placed obliquely; its upper part being turned outward, and its lower part inward. It is slightly concave externally.

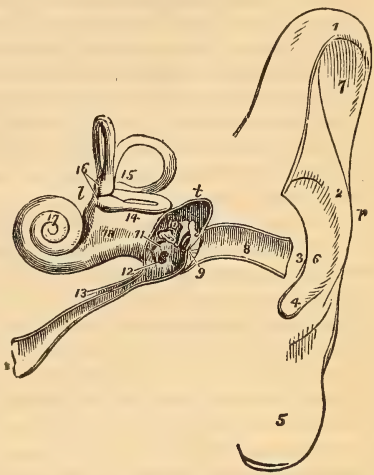
How is it composed?—Of two laminæ, of which the internal one is a production of the periosteum of the tympanum, and the external one of the cuticle lining the meatus externus.

What bone is attached to the inside of the membrana tympani?—The malleus.

What is the use of the membrana tympani?—It transmits the vibrations to the chain of bones contained in the cavity of the tympanum.

Where is the cavity of the tympanum or middle ear situated? (Fig. 109.) — Immediately within the membrana tympani, in the substance of the temporal bone.[9]

Fig. 109.



What is its form? — It is irregular, resembling a portion of a cylinder; its outer side is formed by the membrana tympani; its inner side is bony, and divides this cavity from the labyrinth; its circumference is irregular.

What openings are there at the circumference of the tympanum? — One anteriorly from the Eustachian tube, and another posteriorly to the mastoid cells.

By what is the cavity of the tympanum lined? — By periosteum.

What are the contents of the cavity of the tympanum? — Air, and the ossicula auditus, with their muscles and ligaments.

Where is the Eustachian tube situated? — It extends from the cavity of the tympanum to the root of the pterygoid process of the sphenoid bone; here it opens into the upper part of the fauces, just behind the posterior nares.

Of what parts is it composed? — Of a bony, a cartilaginous, and a membranous portion.

Where is this tube the narrowest? — Its bony part is the narrowest; it expands in the form of a trumpet towards the mouth.

What is the direction of the Eustachian tube? — These tubes, one for each ear, are directed from the tympanum obliquely inwards, downwards, and forwards; so that their anterior extremities, in the fauces, are the nearest to each other.

By what are they lined? — By a membrane resembling that of the nares.

What is the use of the Eustachian tube?[13]—It admits the free passage of air into and from the cavity of the tympanum, and preserving an equilibrium with the external air, enables the membrane of the tympanum to move freely.

Into what part of the tympanum do the mastoid cells open? — Into the posterior and upper part, by a considerable aperture, and are wholly cellular.

Enumerate the bones of the ear. — The malleus, the incus, the os orbiculare, and the stapes.[10]

What is the use of this chain of bones of the ear?—By their motions they multiply the vibrations they receive from the membrana tympani, and transmit them to the fluid contained in the labyrinth.

What is the situation and form of the malleus?—It is placed upon the inner side of the membrana tympani, having its extremity turned downward; a short process at the top of the handle; a long process, called processus gracilis, turned forward over the inner edge of the ring of this membrane; a neck which projects inward from the handle, forming an angle with it, and surmounted by a round head, by which it is connected to the incus.

What muscles are attached to the malleus?—The tensor tympani, fixed to the posterior and upper part of the handle; the laxator tympani major, attached to its long process; and the laxator tympani minor, fixed near its short one.

What is the situation of the incus?—It is situated between the malleus and os orbiculare, extending backward toward the mastoid cells.

What is its form?—It consists of a body, a short and a long leg; its body is articulated with the head of the malleus; its short leg rests on the opening of the mastoid cells, and its long leg bends inward and downward to the orbiculare.

What is the size of the os orbiculare?—It is the smallest bone in the body, being not larger than a small pin's head.

What is its situation?—It is placed between the point of the long leg of the incus and the head of the stapes.

What is its form?—Flattish circular.

What is the situation of the stapes?—It is placed immediately behind the os orbiculare, and extends to the fenestra ovalis on the inner side of the tympanum.

What is the form of the stapes?—It precisely resembles a stirrup.

What occupies the space between the legs of the stapes?—A fine membrane, which is fixed in the groove on their inner sides.

What is fixed to its head?—The stapedius muscle.

What is the situation of the fenestra ovalis?—Toward the upper part of the inner side of the tympanum.

What is the situation of the fenestra rotunda?—It is very small, placed toward the lower part, and covered by a membrane.

Where is the promontory of the tympanum situated?—Immediately over the fenestra rotunda.

Where is the hollow bony pyramid of the stapedius situated?—Immediately behind the fenestra ovalis, near the circumference of the tympanum, and contains the stapedius.

What direction does the fallopian aqueduct assume on the inner side of the cavity of the tympanum?—It is marked by a rising, which passes first above the fenestra ovalis, then behind it and the fenestra rotunda.

What is the situation of the labyrinth?—Within the substance of the petrous portion of the temporal bone.

Of what parts does it consist?—Of several contorted cavities, which communicate with each other, and are divided into three, viz.: the vestibulum, semicircular canals, and cochlea.

What are the contents of the labyrinth?—The membranous labyrinth lining the canals of the bony labyrinth, and consisting of a delicate membrane containing the liquor Cotunnius, and two small masses called *otoconites*, composed of phosphate and carbonate of lime.

What fluid exists between the bony and membranous labyrinth?—The perilymph, (Scarpa.)

What within the membranous labyrinth?—The endolymph.

What is the use of this fluid?—It being incompressible, transmits and conveys the undulations it receives, all over the nervous membrane which lines the labyrinth.

What is the situation of the vestibulum?—It occupies the middle of the labyrinth; the cochlea being placed before, and the semicircular canals behind it.

What is its form?—It is of an oval figure, but irregular.

What opening is there in the external side of the vestibulum?—The fenestra ovalis.

What are the openings on the posterior side?—There are six openings on its posterior side; five great openings belonging to the semicircular canals, and one very small, of the aqueduct of the vestibulum.

What opening is at the anterior side?—That which leads to the external or vestibular scala of the cochlea.

What is the direction of the aqueduct of the vestibulum?—It passes in a curved direction backward and inward.

Where is the external opening of the aqueduct of the vestibulum?—About half an inch behind the meatus internus, upon the posterior side of the os petrosum.

Where are the semicircular canals situated?—Behind the vestibulum.

What are their names?[15]—The superior, posterior, and external, or horizontal.

Where do they terminate?—In the vestibule by five openings; one end of the superior and another of the posterior canal meet, and form a common opening.

What are the ampullæ[16] of the semicircular canals?—Each canal has one of its extremities of an elliptical form, and more expanded than the other, called its ampullæ.

Where are the ampullæ of the superior and posterior canals situated?—At their separate openings.

Where is the ampullæ of the external canal situated?—At its superior or external opening.

Where is the cochlea situated?[17]—Immediately before the vestibulum, with its base towards the meatus auditorius internus.

What is its form?—It is a double spiral, conical canal, resembling the shell of a snail internally.

By what is the spiral canal of the cochlea divided?—By a septum, partly bony and partly membranous; the bony part is called lamina spiralis, the membranous part zona mollis.

What are the names of the two parts into which the canal of the cochlea is divided, and where are they situated?—They are called the gyri or scalæ. One is situated externally, opens into the vestibule, and is called scala vestibuli;[12] the other is situated internally, terminates at the fenestra rotunda, and is called scala tympani.[12]

Where do they communicate with each other?—At the apex of the cochlea, where they wind round a conical pillar called modiolus.

What is the infundibulum?—A small hollow cone surmounting the apex of the modiolus.

How do the filaments of the portio mollis pass into the scala?—By numerous small apertures on each side of the lamina spiralis and the modiolus.

Where are the branches of the portio mollis chiefly ramified?—Upon the lamina spiralis and zona mollis.

Where is the meatus auditorius internus situated?—On the posterior side of the os petrosum.

What is its form?—It is a short tubular canal of some size, terminated by two fossulæ.

What does the meatus internus contain?—The portio mollis and portio dura of the seventh pair of nerves, and a small artery.

Where does the fallopian aqueduct commence, and what is its course?—From the upper part of the superior fossula, and it passes outward through the upper part of the os petrosum; then bends downward and backward, lying on the inner side of the cavity of the tympanum behind and above the fenestra ovalis. It terminates in the foramen stylo-mastoideum.

What passes through the fallopian aqueduct?—The portio dura or fascial nerve.

By what nerve is the portio dura joined in the fallopian aqueduct?—By a twig of the vidian nerve through a foramen on the upper and fore part of the os petrosum, and by the chorda tympani, from the cavity of the tympanum.

What is the course of the chorda tympani?—It proceeds through the cavity of the tympanum between the handle of the malleus and the long leg of the incus, and passes through the fissure glasseri.

How is the portio mollis distributed?—It enters by numerous small apertures, and is spread out within the labyrinth in the form of a delicate pulpy membrane, giving a lining to it in addition to the periosteum.

What is the immediate organ of hearing, and which perceives the impressions of sound?—The portio mollis, which divides into a vestibular and cochlear branch.

PART II.

PHYSIOLOGY.

ORGANIZED AND UNORGANIZED BODIES.

WHAT is physiology?—That science which treats of the conditions, phenomena, and laws existing in living beings in a state of health.

Is every living being *organized?* —Yes.

What do you understand by an organized and unorganized body?—An organized body is composed of different organs having their definite structure distinct from other parts, and adapted to certain ends. An unorganized, or inorganic body, has not the same distinctness and variety of structure in its component parts, and has not the adaptation of its parts to separate functions, and is resolved by chemical analysis into its ultimate principles.

In what conditions do we find organized bodies? — That of life, or state of, or capacity for, action — or of death and cessation of vital action, soon followed by disintegration of the organized body.

What peculiarities do we find existing in organized bodies? — In organized bodies in active life we find processes which provide for growth and nutrition, and resist the destructive influence of surrounding agents, favoring the development and preserving the integrity of the body itself. But sometimes we find in some organized bodies an apparent *dormant* condition of life, which life is not manifest unless under favorable circumstances — for example, the seed, the egg.

May not those processes which denote vitality in some intances *become dormant?* — Yes; as in the case of mosses in dry weather, and the wheel animalcule.

Into what may inorganic bodies be resolved by ultimate chemical analysis? —Into hydrogen, nitrogen, carbon, and a large variety of other simple elements, which simple elements unite in certain definite proportions, forming compound inorganic substances.

Into what may organized bodies be resolved by chemical analysis? Into inorganic simple elements; but the list of simple substances is only seventeen or eighteen.

Which of the elements will always be found in organic compounds? — Oxygen, hydrogen, carbon, and nitrogen; two of these, at least, are found in every organic compound, and the four are called essential elements.

What are the other simple substances existing in smaller quantities in the body, and hence called incidental? — Sulphur, the most nearly constant element, existing in albumen, fibrine, caseine, gelatine, &c. Phosphorus, in combination with albumen and fibrine, in the brain, and as phosphoric acid, in combination with alkaline and earthy bases, abundantly. Silicon, in the urine, bones, hair, &c.; but it more prominently exists in the vegetable kingdom. Chlorine, abundant in combination with sodium, potassium, anmonium, and their bases; in the fluids as well as the solids of the body. In some animals it exists as forming hydrochloric acid, necessary for their digestion. Fluorine, in the bones, teeth, urine, and more in fossil bones than recent. Potassium and sodium exist in the blood and all the fluids. Calcium, the oxyde or salts of lime, are the most abundant in the earthy salts of the body; the phosphate of lime in the lymph, chyle, and blood, and most other tissues, but especially in the bones and teeth. Magnesium as an oxide, is less frequent than calcium, excepting perhaps in the muscle. Iron, in the hematosine or colouring matter of the blood, &c. Manganese, in the human hair by some, by others in gall-stones and in the blood. Aluminum, iodine, and bromine, have also been noticed by some.

What exists between the elementary substances and the organized animal or vegetable texture? — Compounds called *proximate principles*, *organic compounds*, or *organizable substances*, obtained in the first stage of chemical analysis of animal or vegetable tissues; as from muscle we first obtain *fibrine*, which may be resolved again into oxygen, hydrogen, carbon, nitrogen and sulphur—*simple elements*.

What are the true proximate principles as distinguished from secondary organic compounds? — The first of these, as gluten, starch, lignine, in vegetable textures, and albumen, fibrine and caseine, from the animal ones, are those obtained by the analysis of organized textures; while in the secondary, these again form a variety of combinations by various processes, as when boiling starch in dilute acids is converted into a kind of gum, and starch sugar, &c.

As a general rule, in analyzing true proximate principles of organic substances, of what do they consist?—Of three or four of the essential simple elements, though among the secondary products of the vegetable class we find a few instances of binary compounds of simple elements.

Does then not much uncertainty still exist in the manner of combination of the simpler organic compounds? — Yes; no one has yet succeeded in the synthesis of any of the true proximate principles. The formation of urea, a secondary compound, and allantoin and formic acid, have however been effected.

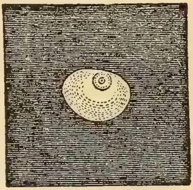
DISTINCTIVE CHARACTERS OF ORGANIZED ORGANIC SUBSTANCES.

What are the distinctive characters of an organized organic substance? — It contains water; its form is more or less rounded, free from angularity, and never crystallized. When hardness is required, the amount of water is small, and an inorganic material is joined with the organic, as in bones, phosphate of lime with the gelatin of the bone, &c.

How is an organized body composed? — Of parts distinct from each other in structure and function, and these again subdivided into a series of textures, differing from each other in physical and vital properties. Where a great variety of texture exists, a high degree of organization is indicated.

What is the most elementary organic form? (Fig. 110.) — A cell containing another within it (nucleus), which contains a granular body (nucleolus).

Fig. 110.



What are some of the laws of every organized body? — It is limited in duration: "a time to be born, and a time to die;" and at death, passes into combinations of the inorganic elements. Organized bodies in their origin are derived from similar ones. They also enjoy the power of conservation and reproduction. They can appropriate and assimilate to their own textures, substances, organic or inorganic. They can also throw off effete particles from their organism.

What would be the effect if the function of assimilation alone existed, without that of excretion, or the reverse? — Growth would be unlimited, or disorganization would soon ensue.

When death takes place, what effect is produced upon living organized structure? — Decomposition, facilitated by air, moisture, a certain temperature, or contact with an organic substance, being in the state of decomposition.

What are the varieties of decomposition? — Fermentation and putrefaction.

What are the chief differences (from what has been said of organic substances) compared with inorganic? — First, as regards form, the inorganic are æriform, liquid or solid, easily assume the crystalline form; no distinction of parts or organs; they are unlimited in size and duration, excepting when acted upon chemically or mechanically; they have no power of reproduction, no excretion or generation, &c. In the living organism, on the contrary, we have constant motion and change.

DIVISION OF ANIMAL FROM VEGETABLE LIFE.

Is the precise boundary between animal and vegetable life easily marked? — No.

What is meant by the term *functions*, in Physiology?—The various processes by which the varied motions and changes are effected in living beings.

What are the objects of these functions?—The preservation of the individual, and propagation of the species. The former is termed *nutritive;* the latter, *generative.*

What is the first step in the nutritive functions?—The formation of a fluid adapted to the nourishment of the textures, and to supply materials for the secretions. In plants it is the *sap;* in animals, *blood.*

Does not the process of *absorption* precede the perfect development of the nutritive fluid?—Yes.

What is the difference in the process of *absorption* in plants and animals?—In plants, the spongioles of the roots take up the fluid necessary, already formed in the soil; in animals, a more or less elaborate *digestion* takes place before the fluid is properly formed to furnish materials for *blood.*

Is not a stomach or digestive organ characteristic of animals?—Yes. There appears, however, to be an apparent exception in the case of the pitcher-plant (ascidia).

What cases are there in the animal kingdom which have no stomach, and nutrition is derived by absorption from the general surface?—The *Volvax globator*, the Acephalocyst, and the Echinococcus.

What difference is there between the nature of the food in animals and plants?—The former derive theirs from the organized world; the latter appropriate inorganic matters, as carbon, carbonic acid, ammonia, &c.

In either case, how is the nutrient fluid supplied to the animal or vegetable?—By the *circulation*, a vital or physical force, or both.

What is the distinction between the animal and vegetable, as regards a propelling force?—In most animals we have a *heart* as the propelling power, and *a true circulation;* in plants we have no propelling organ, but the fluid rotates within cells. In some animals, as the entozoa, the textures seem to imbibe the fluid in which they live.

What is another essential for organized beings?—Atmospheric air, which plays an important part in *respiration.*

What is that process termed by which certain materials are separated from the fluids of animals and vegetables?—*Secretion*, which separates some parts for further use in the economy, and eliminates others which are prejudicial.

What are those functions which are pre-eminently *animal?*—Volition, or will, implying consciousness, sensation, &c.

Is not the *nervous system* a peculiar characteristic of animals?—Yes.

What is the simplest idea of mind?—A power of perception and volition.

What is the chief mental distinction between man and the lower animals? — The power of abstract reasoning.

FLUID AND SOLID CONSTITUENTS OF ANIMAL BODIES, &c.

Of what are animal bodies composed? — Of fluids and solids; the former, the blood chyle, liquid secretions of glands — the latter, in the textures and viscera.

What is the proportion of the solids to the fluids? — The fluids vastly preponderate.

What is the most important constituent in animal bodies? — Water, forming four-fifths, or a large part of the blood, gives flexibility and softness to the solid textures, is a solvent to organic matters, and plays an important part in the various chemical operations of the body, &c.

By what means do we obtain from the solids and fluids the *proximate principles*, before described? — By chemical.

What are the proximate principles? — Albumen, fibrine, caseine (compound of proteine), gelatine, chondrine, elaine, stearine, margarine, hæmatosine, globuline.

What are the secondary organic compounds? — Urea, uric or lithic acid (in the urine), cholesterine in the bile, biliary matters, pepsine in gastric juice, sugar of milk, lactic acid, kreatine.

What are the properties of albumen? — It is both fluid and solid; is white when solid, coagulates by re-agents, and only becomes solid in natural state by loss of water; it is hence coagulated by heat; it becomes solid under the influence of galvanism, is soluble in caustic alkalies, and contains sulphur.

In what does fibrine exist, and what are its peculiarities? — It exists in muscle, solid; also in the serum, chyle, and lymph. It may be obtained by stirring blood as it flows from a vein, and washing, or washing the clot, and digesting afterwards in alcohol and ether; we find it also in the sacs of old aneurisms, laminated. It is white, tasteless, inodorous, and elastic; insoluble in hot and cold water, alcohol, and ether; acetic acid converts it into a jelly mass. It is dissolved by alkalies; cold hydrochloric acid dissolves it. The addition of caustic potash, common salt, and carbonate of potash in certain quantities, prevent the coagulation of fibrine in the blood.

Describe caseine. — It has many of the properties of albumen and fibrine; is found abundantly in milk; it is coagulated by rennet assisted by heat, through the presence of pepsine; reagents affect it similarly to albumen. Heat and acid coagulate it, and an excess of acid redissolves it. It contains sulphur.

What is proteine? — When albumen or caseine is dissolved in a moderately strong solution of caustic potash, and exposed to high temperature for a time, it becomes decomposed, and by the addition of acetic acid, a translucent gelatinous matter is precipitated, which

is called *proteine*, (from the word πρωτευω, I am first,) as the radicle of the proximate principles. It is, when very hard, tasteless, insoluble in water and alcohol, and brownish-yellow; attracts moisture from the air; soluble in acids, and dilute alkalies, and solutions of alkaline earths.

Has not the existence of proteine been doubted by some recent observers? — Yes.

May not proteine be obtained from similar elements in the vegetable kingdom? — Yes.

What is pepsine? — A peculiar substance evolved from the mucous coat of the stomach; it has also been called *gasterase.*

How is gelatine obtained? — From the white fibrous and areolar tissues, skin, serous membranes, bones, and by boiling and cooling, and then by driving off the water by a gentle heat we have it dry, which is hard, transparent, without smell or taste; dissolves in hot water; insoluble in alcohol and ether; soluble in dilute acids and alkalies. Tannin, added to a solution in water, throws down a brownish precipitate. Proteine cannot be obtained from gelatine. Scherer, however, says that gelatine contains the elements of two equivalents, three of ammonia, and seven of water.

Describe chondrine? — It is similar to gelatine, and is obtained in solution with boiling water from permanent cartilages, and from temporary ones, prior to ossification, and from the cornea. It gelatinizes when cool; is not precipitated by tannin, but is so by acetic acid, alum, acetate of lead, and protosulphate of iron. It contains a small quantity of sulphur.

What are elaine, stearine, and margarine? — The proximate principles of fat; the first is the fluid and the second the solid, which are also found in the brain and nerves. Stearine exists sparingly in human fat.

What are hematosine and globuline?—The constituents of the blood corpuscles — the former giving it color; they are allied to albumen, and the latter has been regarded as a proteine compound.

Where do we find urea and uric acid?—In the urine; though the constituents are the same as in albumen, caseine, and fibrine, we have in these a greater proportion of nitrogen, carbon, &c.

Where is kreatine found? — In the juice of flesh, crystalline; with neither acid nor basic properties, soluble in hot water; strong acids change it into kreatinine.

From our knowledge of the proximate principles, to what general conclusions do we arrive? — That both the animal and vegetable kingdoms are capable of affording materials for the support of the various vital processes; and that no one proximate principle can support life.

In our present state of knowledge, can we say which particular tissues tend to the formation of secondary compounds? — No.

CLASSIFICATION AND PROPERTIES OF THE TISSUES.

Give an example of the simplest form of simple membrane. — The posterior layer of the cornea, capsule of the lens, sarcolemma of muscle, &c. Its principal feature is extension, and is employed to form muscle, nerve, and adipose and tegumentary tissues.

Describe the filamentous or simple fibrous tissues. — These are the white, yellow, and areolar; the first of these is used for connecting different parts, and the last more particularly for associating the elements of other tissues. The ligaments of the joints are examples of the first, and the tissue which surrounds and connects elementary parts of nerves, vessels, &c.

What do we understand by a *compound membrane?* — Those expansions which form the external integuments of the body, and are continued in the internal passages, forming various involutions, secreting organs and glands. The *hair* and *nails* are regarded as appendages to this membrane.

Are not the serous membranes included in this class? — Yes.

What are examples of tissues which preserve their primitive cellular structure more or less completely?—Cartilages, adipose tissue, and gray nervous matter.

What are the sclerous or hard tissues, and why called so? — The bones and teeth, and contain a large proportion of earthy matter.

What are compound tissues? — Those which are composed of two distinct tissues, as in muscles, where we have parallel fibres, each fibre composed of homogeneous membrane, arranged as a tube, and containing a fleshy substance. In nerve we have similar homogeneous tubes containing *neurine* and oleo-albuminous substance. In addition to these we have fibro-cartilage, composed of white fibrous tissue and cartilages, as seen in the mechanism of the joints.

DEVELOPMENT OF TISSUES FROM CELLS, AND PROPERTIES OF TISSUES.

Give a general account of the above formation? — We have generally the *ovum* or egg within the parent, containing the rudiments of the future being, with a nutrient material, to suit its condition. We have in this *ovum* a vesicular body, or vitelline membrane, containing a fluid, which encloses another body, or *nucleus*, which contains again another one or (nucleolus); from the nucleolus a series of changes arise, from which new cells are formed for the future embryo. New cells are now formed within the old; by the subdivision of the nucleus into two or more segments new cells are again formed. Or the growth may be by granular deposit (or cytoblastema), between the cells; when new cells take place, and the cohering of granules in separate groups to form nuclei (or cytoblast), around which a cell-membrane is thrown.

What are the changes which the cell undergoes in forming the tissues?—The cell-membrane, where the tissues are ultimately to be fibrous, becomes elongated and folded, or divided so as to give the appearance of threads; and when the tubes are of a homogeneous membrane, containing a peculiar substance, we have the cells joined end to end, their divisions removed, and they forming tubes. In the capillary vessels the cells coalesce at several points and form ramifications. The nucleus still exist in formed tissues, but are flattened and elongated. In other tissues the cell-walls become thickened by an interstitial deposit, with which they are united and incorporated, and form an intercellular substance, and this substance shows further depositions

Does the formation of cells cease with the infancy of the organism? —No.

How are the properties of the tissues divided, and what are there peculiarities?—1st. Into physical, or such as are dependent upon the arrangement and chemical constitution, viz.: elasticity, extensibility, flexibility, and porosity. 2d. Into vital, which exists during life, and ceases when molecular life ceases, evincing itself by changes and feelings when stimuli are applied; as in muscle, where contractility is evinced by stimuli, &c.; in nerve, where no perceptible change is seen, yet is known by the influence exerted upon the different parts to which it is supplied, or are contiguous; or by connection with the brain, and producing different degrees of sensation; besides we have nerves of proper or special sensation, where the different senses, as light, taste, odor, stimulate, the nerves which take these impressions to the brain, &c.

LOCOMOTION, &c.

How are the organs of locomotion divided, and what are they?—The passive and the active; the passive consist of those textures which form the skeleton, and by which its segments are united; the active are those muscles to which the nerves convey the behests of the will.

Fig. 111.

Under the passive head we have fibrous tissue; what are its varieties?—The white and the yellow.

Describe the white. (Fig. 111.)—We find this variety existing where we need strength and flexibility, and unyielding characteristics, as in ligaments, tendons, and membranous expansions to protect organs, &c. Areolar tissue dips into the fibrous material and surrounds it, excepting where we have a serous membrane connected with them, or are adherent to bone or cartilage. When the areolar tissue is removed we have a pearly white tissue, in bundles of

fibres, some parallel, and some interlacing or crossing, and showing a great variety of rather membraniform fragments. This tissue is inelastic, cohesive, and inextensible, unless under prolonged force; it is devoid of contractility or irritability; it has few blood-vessels; and no nerves have been demonstrated; it contains water and gelatine.

Describe the different forms of this tissue.—1st. Ligaments which are connected with joints, divided into funicular or rounded cords of this tissue, as the lateral ligament of the knee; fascicular, or flattened bands, as in most ligaments; and the capsular or barrel-shaped expansions, connected by their extremities around the margin of articular surfaces. 2d. Tendons, which connect muscles with bone, and are divided into funicular, fascicular, and aponeurotic, or tendinous expansions. 3d Membranous expansions for protecting and supporting various parts, by dipping in between muscles, &c.

Describe the yellow fibrous tissue? (Fig. 112.)—It exists in the form of cylindrical fibres, breaking abruptly and curling, of a dark border; it is little changed by boiling; it is unaffected by weak acids, and is of great elasticity, but very slight tendency to decomposition; it exists in the ligamentii sub-flava, in the middle coat of the arteries, chordæ vocales, &c.

Fig. 112.

Describe the *areolar tissue*, or, as formerly improperly called, the cellular.—This tissue is largely disseminated through the system; examined microscopically, it presents a net-work of minute interwoven fibres or bands, partly of white, and partly of yellow tissue, communicating with each other; the white (Fig. 113,) or yellow variety predominating according to the situation and use of the parts where either exists; it yields gelatine on boiling; the instertices in it are filled with a serum-like fluid, consisting chiefly of water, with a quantity of salt and albumen, &c. This tissue connects different parts requiring motion, and supports the vessels supplying different parts; it has low *vitality*, is extensible, elastic, without contractility. It has very little, if any, power of absorption.

Fig. 113.

Give a general account of the adipose tissue and of fat.—It has no

alliance with the areolar. The adipose tissue is a membrane of great tenuity, of closed cells; transparent, of $\frac{1}{20000}$ of an inch in thickness, with the fat contained within them deposited by the blood-vessels; is moistened with a watery fluid; is homogeneous, simple membrane; each vesicle is perfect in itself, and supplied with blood-vessels, but has no lymphatics or nerves. The fat vesicles, when aggregated together, assume a polyhedral figure (Fig. 114), but when separate, are round. When fat is in abundance, it is divided in small lobules, with areolar tissue between them, admitting the passage of blood-vessels and allowing motion. (Fig. 115.) The fat is a white or yellowish unctuous substance, unorganized, secreted within the vesicle; it has been divided by chemists into stearine, margarine, and elaine; it is extensively distributed in the animal kingdom. In the human body it exists in the orbits, cheeks, palms of hands, abdomen, mammæ. In the liver, brain, and nerves, and sometimes in other organs, it is *not* in vesicles, but in the elementary parts of the tissues themselves. Fat is a source of nutrition and caloric.

Fig. 114.

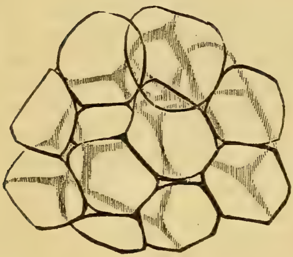
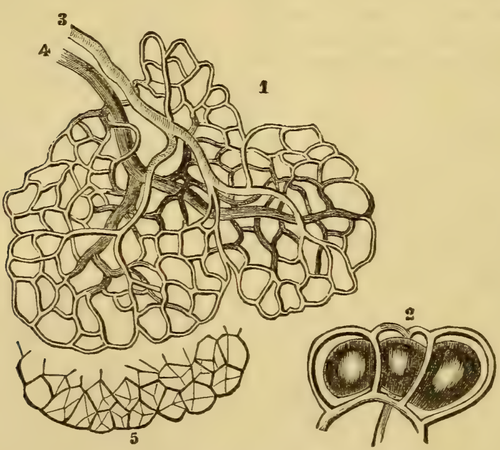


Fig. 115.

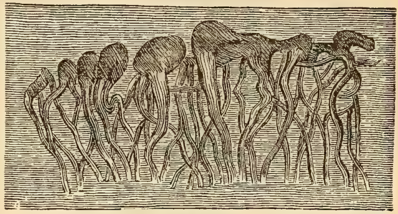


What are the peculiarities of cartilage? — It is one of the simplest of textures, extensively used in the animal frame; one of the first tissues seen as distinct in embryo development. In its simplest form, it consists of nucleated cells; in other forms, the cells are imbedded

in *chondrine*, an intercellular substance; in the higher animals and man, it is temporarily a nidus for bone in the early stages of life, and is then termed *temporary*, after which ossification takes place at different periods. We have also another form of it, called *permanent*, in joints (articular), or in walls of cavities (membraniform), as in cartilage of the ear, Eustachian tube, nostrils, eye-lids, &c. Cartilage is of a pearly or whitish yellow colour, elastic, flexible, and cohesive. They may be termed relatively non-vascular; they are surrounded by blood-vessels, by which they are probably nourished by *imbibition*. They are devoid of nerves and lymphatics, and are never reproduced.

What are the characteristics of fibro-cartilage? — This is a compound of white fibrous tissue and cartilage; is white, with a slight tinge of yellow; has different degrees of density, as the white tissue predominates or not; it is principally used in construction of joints; it is a strong, dense, elastic tissue, and flexible, of low sensibility, and devoid of vital contractility; has few vessels derived from the textures, with which it is in juxtaposition. (Fig. 116.) The existence of nerves in it is doubtful; it contains water, and yields gelatine by boiling. It is divided into articular, in the form of *discs*, in laminæ or *menisci* and *circumferential*, as around the glenoid cavities; *it* heals by a new substance of like texture.

Fig. 116.



BONE—ITS STRUCTURE, DEVELOPMENT, &c.

What are the general characteristics of bone? — Hardness, density, opacity, and a whitish colour. It possesses less water than any other organ of the body. It contains an organic (*gluten*) and inorganic material. By steeping a bone in a mineral acid, we dissolve out the inorganic part, and leave the organic, of the original size and shape of the bone, with the cartilaginous nidus remaining, and the vessels ramifying through the mass. By burning in a crucible, the inorganic part, of slight cohesive properties, remains, and the organic part is destroyed. Both parts are necessary in proper proportions to constitute a healthy, reliable bone. To the organic part is due elasticity, and to the inorganic its density. They resist decomposition for a long time. The organic part consists of cartilage, with medullary membrane and fat, and vessels. The earthy or inorganic, of phosphate and carbonate of lime, with a small quantity of phosphate and carbonate of magnesia.

What are the two varieties of osseous substance in bone? (Fig. 117.) — One dense and firm, either thick or thin on the exterior, and

the other loose, spongy, and reticular inside, forming *cancelli*, or cells, and communicating with each other, formed by the interlacing of bony fibres and laminæ.

Fig. 117.

By what are the bones covered and lined, and nourished? — Externally (excepting on the articular surfaces) by *periosteum*, a dense white fibrous tissue. Internally, the *cancelli* are lined with a delicate membrane called medullary, filled with fat and *medulla*, or marrow. In long bones the marrow is contained in one great canal, and the membrane lines the walls of the canal. These two membranes are abundantly supplied with blood-vessels, which, after ramifying upon them, send vessels into the substance of the bone.

How do we classify bones? — Into long, such as the femur and humerus—when the length is predominant, and are the great levers of the body. Short, as the metacarpal and metatarsal, and phalanges of fingers and toes. Flat; those composed of two thin layers of compact tissue, and internally-cancellated structure, such as the cranial, ribs, scapula, innominatum. The irregular bones, such as the vertebræ, tarsal, carpal, and some of the head and face, are composed of cancellated structure, with only a slightly compact exterior. They are light, and have extensive surface.

What is there peculiar about the cranial bones? — They have an external, tougher, compact tissue, called external table of the skull, and an internal one, which is denser, thinner, and brittle, called internal table. Between these we have a fine cancellated structure, called *diploë*, in some places absent, where the tables are separated and communicate with the external air, as in the frontal sinuses. The mastoid process of the temporal bone has large cancelli, without marrow, and communicates with the cavity of the tympanum.

What are the purposes of the various eminences and projections we see upon bones, and how are they divided? — They are divided into articular and non-articular eminences and depressions. The former for the formation of joints, and the latter, also called tuberosities, spines, cristæ, &c., for the attachment of ligaments, tendons, and muscles The depressions are also termed fossæ, cells, fissures, grooves, &c.

How are bones nourished? — The arteries are generally continued from the periostum; the medullary membrane contained in the shaft is supplied from the nutritious artery, which pierces the compact structure in a distinct canal; which artery divides descending and ascending, and forms a capillary net-work, which anastomoses with a similar net-work in the end of the bones, derived from arteries which enter there. The compact tissue is supplied by arteries passing from the periosteum into very narrow capillary canals, called Haversian. They form, more or less, oblong meshes, and freely inosculate. (Fig. 118.) The arteries and veins usually occupy distinct canals, and

Fig. 118.

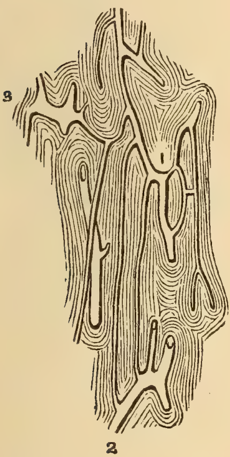
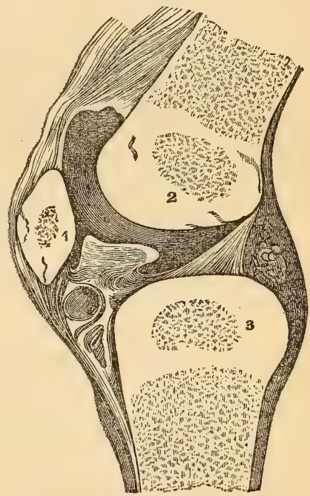


Fig. 119.



the veins are the larger; and where two or more meet, we have pouches formed as a reservoir of the blood.

Are bones supplied with nerves? — Not directly to the osseus matter, though they pass through them, and the vascular surface is supplied with them.

How are bones developed? — In a large proportion of the skeleton, when first detected, we have a congeries of cells, gradually increased in number and density, held together by inter-cellular substance, forming *temporary cartilage*, whose shape is preserved, and is afterwards converted into bone; until ossification is complete, we have the cartilage increased by interstitial new-cell development, with vessels in them. Ossification commences in the interior of cartilages, from distinct points called *centres of ossification*. The first appearance of these points differ as to time in different bones. In most bones we have different centres of ossification; in long bones, we have

a middle one for the shaft, and one for each extremity. (Fig. 119.) The middle portion is called *diaphysis*, and the extremities are called *epiphyses*, between which and the *diaphysis*, we have cartilage remaining, generally, till adult life. Processes of bone generally have their own points of ossification. Ossification generally extends in the direction that the future laminæ and Haversian rods are to assume, and where the chief strength of the structure may lie.

What is meant by intra membranous form of ossification?—Where, as in the tabular bones of the cranium, we have in parts a delicate membrane, composed of fibrous fasciculi, with numerous cells of granular matter of different sizes, and a soft, faintly granular matter between the fibres and cells. Sometimes the fibres, and in others the cells, predominating, the ossification seems at first to consist of the consolidation of the fibres by earthy matter. The newer formed bone consists of a very open reticulation of fibro-calcareous spicula, and the older becomes harder by the increase of the spicula, and possibly by the calcification of the intervening cells. As the process advances, we have grooves radiating from the ossifying centre found on the surface, which are again increased by ossific deposit, and converted into Haversian canals. Further deposits take place on these canals, diminishing their calibre and assisting the consolidation of bone.

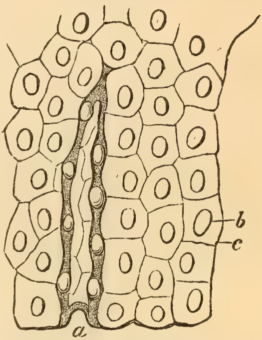
How do bones grow?—By layers, formed on the vascular surface in succession, and also in an interstitial manner, which, however, is limited. The long bones grow by deposits upon their ends, as seen in the experiments of Hales and Hunterly. Two pieces of metallic substances being placed in the shaft of a bone of a pig, at a distance apart, which, after a time being killed, the metal was found in the original position, and bone deposited beyond each piece of metal. They also increase by a deposit of new osseous matter in the exterior, and secretion from the periosteum, and also according to Todd & Bowman, by the dilatation of the primary, cancelli and Haversian canals in the central parts of bone. While we have the external deposit forming bone, we have absorption going on internally.

What are the general laws in regard to the reparation of bone?—In case of fracture, we have blood effused from the ruptured vessels of the bone and surrounding structures; after a time we have semi-transparent lymph mingled with coagulum, covering the surfaces of the hard and soft parts exposed. In the second or third week this is converted into a substance resembling temporary cartilage, in which ossification takes place uniformly, until the fourth or sixth week, when it is transformed into a spongy, osseous mass, investing and extending between the broken extremities, holding them together. If the medullary canal has been broken across, and the ends correctly adapted to each other, we have an interior stem of new bone connecting the medullary canal; the opposed surfaces being connected. The new bone, or *callus*, former called *provisional*, is gradually absorbed, and the permanent *callus*, having the character of true bone, is formed upon the contiguous surfaces of the compact tissue.

SEROUS AND SYNOVIAL MEMBRANES, &c.

Describe the serous and synovial membranes, and their uses.—They are so called from the fluid upon their free surfaces; they are thin and transparent; have some strength, and much elasticity. Examined microscopically on their free surface, we find flattened polygonal cells, (Fig. 120.) constituting a tesselated or pavement epithelium, beneath which is a basement membrane. It is composed of condensed areolar tissue, in which the yellow fibrous element predominates, its filaments interlacing; this gradually passes to the laxer variety, which is attached to the part it covers, or subserous tissue, where we often find fat cells. The blood-vessels are plexiform, and not numerous. In synovial membranes, which exist in joints, they are more numerous, and they have vascular fringe-like processes hanging in the joint, which are covered with an epithelium, whose cells are spheroidal and large, and are probably the secreting apparatus for synovia. The *bursæ*, generally closed sacks, between prominences of bone and tendons, or integuments, &c., are similar to synovial membrane, with, however, a variety in the epithelium and the stages of cell growth. The serous fluid is only sufficient in health to admit of free motion and moisture; it resembles mostly the serum of the blood, with albumen in less proportion. The fluid of synovial capsules and bursæ is more viscid and oily in appearance, and has a larger proportion of albumen than the serous. The uses of all these fluids is to diminish friction between surfaces. In serous tissues the vitality is low, its epithelium is probably permanent. The synovial and bursal membranes have a higher vitality, and their epithelium is frequently removed. All these membranes are easily regenerated when lost. Inflamed serous membranes throw out a plastic exudation easily organized into false membrane. Synovial membranes are not as prone to adhesive inflammation as the serous.

Fig. 120.



What are the serous membranes?—The arachnoid, the pleura and pericardium, the peritoneum, and the tunica vaginalis testes, which are closed at all points, excepting the peritoneum in the female, which communicates with the open extremity of each fallopian tube.

Are nerves and lymphatics found in serous tissues?—Yes, to a degree.

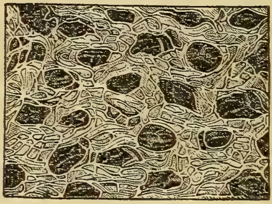
MUCOUS MEMBRANES AND THEIR APPENDAGES.

Describe the mucous membranes.—They derive their name from the peculiar fluid secreted upon them; they are thicker than the

serous, opaque, with slight tenacity; the red color apparent in them is derivable from their free supply with vessels; they have less fibrous tissue in them than in the serous; in some parts it is almost wanting. A distinct basement membrane is not always demonstrable, but generally exists. The blood-vessels and lymphatics are spread out underneath the basement membrane, advancing with it into the villi, and lining the follicles. (Figs. 121, 122.) The follicles are a common arrangement, the villous coat is mostly limited to the gastro-intestinal mucous membrane.

Fig. 121.

Fig. 122.



Has this membrane an epithelial layer?—Yes; it extends over the flat surface, invests villi, and lines follicles. These cells are constantly undergoing change; the older layers passing off, and new ones produced from the surface, or from basement membrane.

Where do we find mucus mostly secreted, and for what purpose?—On the bronchio-pulmonary and gastro-intestinal membrane, to prevent irritation. We also find it in the excretory ducts of glands, and in the bladder, and gall-bladder, in small quantities.

Describe mucus.—It is viscid, colorless, or yellowish-white transparent fluid, and does not mix with water; it contains 2½ to 6½ per cent. of solid matter. Its chief organic constituent is mucin, an albuminous compound, altered by an alkali. Examined microscopically, epithelial scales and mucus corpuscles are seen.

What are the characteristics of the mucous membranes?—They line the tubes and cavities which have external openings, performing different offices; in the gastro-intestinal, we have provision for reducing and absorbing the nutrient material; in the upper part and in the lower, a provision for throwing off the effete material; in the broncho-pulmonary we have the process of respiration assisted by it; and in cell-lined vesicles of glands they form the apparatus for eliminating different products from the blood.

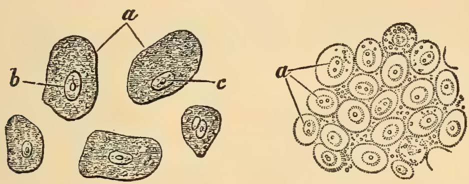
Has this membrane much sensibility, or is it well supplied with

nerves?—No; excepting the parts near external openings, when they possess a peculiar sensibility to protect, and guard, and alarm the particular part.

What is there peculiar in mucous inflammation?—It does not readily throw out plastic exudations, but is liable to suppuration, ulceration, and gangrene. The membrane is regenerated with rapidity, although the follicular structure is not reproduced, excepting in the uterus after its exuviation, in the formation of the decidua. When the cutaneous surface is inverted from any cause, as a boundary to internal cavities, it is changed to all the peculiarities of the mucous membrane.

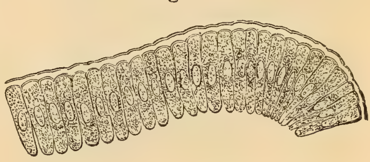
What are the developments made by the microscope relative to the epithelium?—That a continuous layer of epithelial cells exists, not only on the alimentary canal, but also on the free surfaces of mucous membranes and their appendages generally, and on serous and synovial membranes, the lining membrane of the heart, blood-vessels, and absorbents. These cells are chiefly of two varieties, the *tesselated* "pavement epithelium," flattened and sometimes polygonal, (Fig. 123) and cover the before-mentioned surfaces, where the cylinder epithelium does not exist.

Fig. 123.



Where does the cylinder epithelium exist, and what is its appearance?—It covers the mucous membrane, from the cardiac orifice down, and in the larger ducts of most of the glands which open into it, or are upon the external surface: as the ductus choledochus, vas deferens, Cowper's glands, urethra, &c. Its component cells are cylinders, arranged side by side, one end attached to basement membrane, the other forms part of the free surface. (Fig. 124.) It presents various appearances under different aspects.

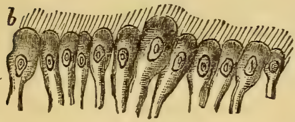
Fig. 124.



What peculiarity exists in the epithelial cells of the urinary passages, from the pelvis of the kidney down, and also in the excretory ducts of the mammary, perspiratory glands, and others?—They preserve their original round form, and are called spheroidal.

What frequently fringes the epithelial cells? — The cilia, (Fig. 125,) which are important and endowed with motor power towards the outlets. They exist upon the cylindrical epithelium in parts of the nasal cavities, the frontal sinuses, maxillary antro, lachrymal ducts, &c.

Fig. 125.



Is not the epithelium frequently exuviated and renewed? — Yes.

Describe some of the appendages of the mucous membrane? — First, the *papillæ* in the mouth and on the tongue, minute elevations, more or less complex; some, "fungiform," with a soft epithelial covering, well supplied with bloodvessels and nerves, to receive the gustative impression; others, "conical," with a bony epithelial covering, less copiously supplied with vessels and nerves, which act mechanically, to abrade and comminute the food. We have also wrinkles, or *rugæ*, of mucous membrane, dependent upon muscular contraction; in the œsophagus and stomach we have also more permanent rugæ, *valvulæ conniventes* in the small intestine; these folds increase the absorbent surface. Again, there also exist *villi*, prolongations of basement membrane, supplied with blood-vessels from the adjacent surface, containing lacteal tubes; sometimes they are cylindrical and conical; they vary from one-fourth to one-third of an inch, and are the chief means of absorption, by their bloodvessels and lacteals. There also exist *follicles*, formed by the inversion of the mucous surface, the reverse of the former in structure and function cylindrical, with orifices opening upon the free surface of the membrane, in the interspaces of the vascular net-work, and abut against the submucous areolar tissue. They exist throughout the gastro-intestinal membrane; their secretion differs, as in the stomach we have gastric follicles to pour out the digestive solvent; in the intestine they pour out protective mucus, and are called *follicles of Lieberkuhn.* There are also other simple glandulæ upon the intestinal surface.

What are the *agminated glands of Peyer*, and the glands of Brunner? — Elevated patches on the small intestine, and may be considered as secreting parent cells, developed in the tissue independently of the mucous surface, and only connected with this surface to facilitate the exit to their contents. They are probably a type of original complex glandular structure. Brunner's glands are situated in the duodenum, a type of more complex glandular structure.

Fig. 126.

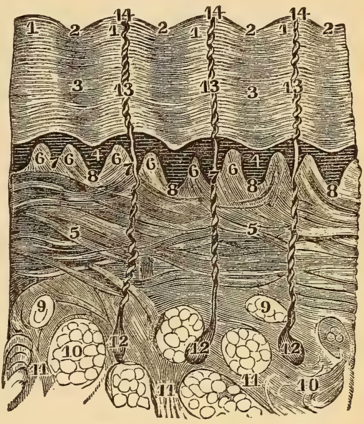
Are not all glandular bodies freely supplied with blood? — Yes, it

is essential to their office; a minute capillary invests their follicles, but never penetrates their interior. (Fig. 126.)

THE SKIN.

Describe the skin. (Fig. 127.)—It is composed of white and a small admixture of yellow fibrous tissue, reticularly arranged with bloodvessels, lymphatics, and nerves, forming the *cutis vera* or *corium*, a layer of basement membrane investing this, and an epithelium of peculiar thickness and tenacity, called epidermis, or *cuticle*, covering the whole body, not excepting the conjunctiva and cornea. The cutis is possessed of elasticity and vital contractility, as seen in the condition called "cutis anserina." The external surface of the cutis is elevated in many parts into papillæ or ridges, conical elevations, to receive tactile impressions, by the nerves, forming loops, with which they are supplied. In the palms, sole, and nipple they are compound cones, and are set curvilinearly, with furrows traversing them, into which the sweat glands discharge. In the matrix of the nail, where they are large and numerous, their office is different, and afford surface for the production of epidermic cells. We have also upon the surface depressions, lined with cells, sometimes simple follicles, and sometimes tubuli. The functions of these cells in the follicles differ in different parts, as in the hair follicles we have them producing hair, chemically identical with the epidermis; in the sebaceous ones they draw fat from the blood, and discharge it upon the skin. We also have the cerumen glands in the ear, the sudoriparous glands all over the body to take off the watery fluid, in which there is effete material; and the odoriferous glands in the axillæ.

Fig. 127.



Describe the sebaceous and sudoriparous glands.—The sebaceous glands are minutely lobulated, composed of an aggregate of vesicles, filled with an opaque, soft substance. They are overspread with minute capillaries, and their ducts generally open in the hair follicles. The secretion from them keeps the surface of the skin in a healthy, soft, pliant condition; they exist chiefly upon parts supplied with hair, and at the entrances to the cavities of the body. The sudoriparous glands consist of small, long, convoluted tubes, most frequently double,

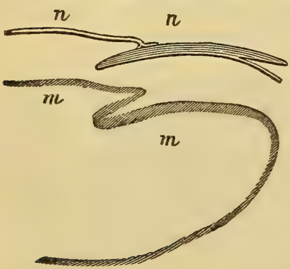
seated beneath the cutis, in the subcutaneous adipose tissue; all the tubuli of the glands coalesce and form one corkscrew-like duct, passing through the cutis and cuticle, and opening upon its surface obliquely. The secretion from these glands is usually acid, with some animal matter and salts, (chlorides); it is generally evaporated as soon as thrown out, forming insensible perspiration; when it is excessive, or not carried off so rapidly, on account of the atmospheric state, it forms the sensible perspiration. This secretion is depuratory, and vicarious with that of the kidney, both eliminating superfluous azotized matters. The amount of solid matter thus thrown out is 100 grains in twenty-four hours. The odoriferous glands are similar to the sudoriferous, but secrete a peculiar odourous matter.

Is not the cutis easily regenerated? — Yes; it is doubtful, however, whether the hair follicles and sudoriferous glands are.

Describe the epidermis, or cuticle.—It is a semitransparent pellicle, of flattened scale-like spheroidal cells when first formed, in close apposition to the cutis; irregular on the under surface; level on the tops; of variable thickness in parts subjected to pressure or use. The cells are in different layers; the older are compact and horny; the newer are soft, without tenacity; as the outer parts become more scaly they are thrown off, and new ones take their place. The newer, or internal layer, was originally called *rete mucosum*. We have also cells mingled with the epidermic cells; others called *pigment* cells, polygonal in form; they are more marked in the internal layer, and are like the epidermic cells, drying up in scales, and passing to the surface; they exist in the pigmentum nigrum of the choroid coat of the eye. The development of these cells is influenced by light. The epidermis is a protection to the cutis.

What are the nails, hoof, horn, &c.? — An altered form of epidermis. The nail is produced from the cuticle beneath, folded into a groove at its root, (Fig. 128) very vascular, and has longitudinal elevations where the blood-vessels are largely distributed. It is prolonged by additions to its root. If the matrix of the nail has not been injured, it is readily reproduced. The hair contains a distinctly organized structure, formed by the conversion of cellular matter. At its roots, it consists of a cortical, fibrous, horny texture, and a medullary portion. The prolonged portion or shaft is covered with imbricated flattened cells or scales; within this a cylinder fibrous texture, in which are the pigmentary granules and lacunulæ, containing air, which appear dark by transmitted, and white, by reflected light. Within this cylinder we generally have the medullary portion of spheroi-

Fig. 128.



dal cells, with pigment in them. The base of the hair expands into a bulbous extremity, lodged in a follicle, which has a very complex arrangement, formed by a depression in the cutis, lined by the epidermis. The hair is elongated by additions to its base. Hair has a vital — not vascular connection with the body. It may be regenerated if the follicles and papillæ are uninjured.

THE TEETH.

What are the three constituent substances of the teeth? — Dentine, which gives form, size and hardness to both root and crown, containing within it the cavity for the pulp, supplying vessels and nerves. It is a modification of bone; it has a finely granulated ultimate texture, perforated with minute canals which contain vessels, largest at the pulp cavity, and retain their form. These tubes radiate from the vascular surface, nourishing the dentine, and affording greater strength by their arrangement. The enamel which invests the crown of the tooth, is harder and more compact than dentine, with a larger proportion of earthy constituents; is formed of a congeries of hexagonal rods, placed side by side, in a wavy course, in a vertical position; and in the interstices, the fluids derived from the dental tubuli, permeate to nourish it. The tooth bone or crusta petrosa is disposed as a permanent thin layer on the roots of the teeth; also thinly on the emerging tooth; it is thickest at the apex; it contains a few lacunæ and canaliculi of bone.

How are the teeth developed? — From the mucous membrane, covering the dental arches, where the first indication is a groove at the border of the palate, where the situation of the future teeth is seen, from which future developments progress.

What are the different stages of development in the teeth?—First, the papillary; second, the follicular, which terminates when the papillæ are hidden by the closure of the mouths of the follicles, and of the groove itself. This is succeeded by the saccular. When the dentine and enamel is formed, and the ossification of the jaw takes place, with the changes necessary to receive the teeth, the fourth or eruptive stage happens from the lengthening of the fang by the addition of new dental substance, forming the crown against the closed sac, finally rupturing it, when further changes occur.

CAPILLARY BLOOD-VESSELS AND ABSORBENTS.

What are the characteristics of these? — These are instances of simple tubular tissues, which appear to be formed in the *vascular layer* of the germinal membrane by the coalescence of cells forming tubes. These exist in the higher adult animals; these tubes having distinct membranous walls. They are an elementary part of the fabric, and the changes which take place between the blood and surrounding parts, by which nutrition, secretion and respiration

takes place, as the blood circulates through these vessels; the larger vessels, the arterics, only bringing a fresh supply, and the veins taking away the impoverished fluid. The diameter of the capillaries varies according to the size of the blood corpuscules; in man they are estimated at from $\frac{1}{3700}$ to $\frac{1}{2500}$ of an inch. They apparently dilate and contract under the supply of blood. Their distributive force appears independent of the heart's action, influenced by the attraction between the tissues and the constituents of the blood.

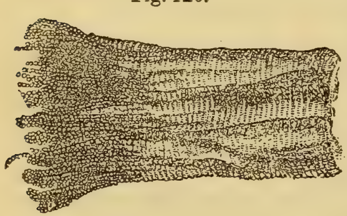
Is it true that the white tissues are nourished by white blood? — No; in cartilages no vessels have been discovered; in others the blood is so scanty as not to communicate any decided hue.

Is not the structure of the minutest absorbents similar to the capillary blood vessels? — Yes.

MUSCULAR TISSUE.

Give an account of the use and character of muscular structure. — The muscular tissue, or *flesh*, consisting chemically of fibrine, is the instrument for the performance of all the sensible movements of the body. The ultimate fibres exist under two forms. They are chiefly concerned in various movements of the body, and affected by the agency of the nervous system, and, belonging more properly to animal life, are marked by *transverse* and *longitudinal striæ*, and called voluntary. The other, which are less under the influence of the nervous system, and more readily excited by stimuli directly applied, appear more directly involved in the vegetative or organic functions. They are *plain*, *smooth*, and *unstriped;* and are called involuntary, excepting in case of the muscles of the heart and œsophagus. Muscle examined presents a fibrous appearance, with the fibres arranged regularly in the direction of the action of the muscle. More closely examined, we find the fibres arranged in *fasciculi*, or bundles, connected by areolar tissue; and when the smallest fibre is examined, we find it also consisting of a fasciculus of cylindrical fibres, lying in a parallel direction, bound together. We have in these primitive fibres two *striæ*, or markings; the one longitudinal, the other transverse, or annular. By splitting a fibre in its longitudinal direction, we have it divided into *fibrillæ*, which present a beaded appearance (Fig. 129) on account of the arrangement of the tube. If a force is applied, it as often happens that the contents of the fibre separate in the direction of the transverse striæ, forming disks (Fig. 130); and if there was a general disintegration of the structure in both directions, we would have a series of *primitive particles* or *sarcous elements*, by which union the mass of the fibre is produced.

Fig. 129.

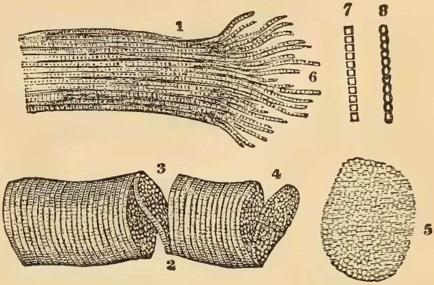


How are the elements of muscular fibre bound together? — By a delicate tubular sheath, distinct from areolar tissue, which is transparent, tough and elastic, called myolemma, or sarcolemma.

Is it perforated by the blood-vessels or nerves? — No.

What is the form of muscular fibre, and average size? — It is rather polygonal than cylinderical, and is $\frac{1}{400}$ of an inch in man.

Fig. 130



What is the appearance of the fibrillæ when separately examined? —They present an alternation of dark and light spaces, corresponding with the transverse striæ, and lighter intervals between them, which gives the beaded appearance, which is however an optical illusion. As the border of the fibrillæ is straight, each dark space is surrounded by a pellucid border, forming a complete cell, and the fibrillæ consist of an aggregation of cells.

What is the effect of muscular contraction upon these cells? — The cells of the ultimate fibrillæ are changed in form.

What is the disposition of the fibres during muscular contraction? — There is an approximation of the transverse striæ and shortening of the fibre, and its diameter is increased.

How do muscles grow? — By an increase in the bulk of the elementary tissue, and not in the number.

To what is every fibre of striated muscles attached at its extremities? — To white fibrous tissue, a union of which forms tendon.

What is the general appearance of the unstriped muscular fibres? — They consist of flattened bands, generally of a pale colour, bulged at frequent intervals by elongated corpuscles. Their texture appears homogeneous. Generally they have no fixed points, but form continuous investments around cavities lined with membranes, and are diffused through the skin.

What is peculiar in the muscular structure of the heart? — It has the general arrangement of the non-striated muscles, with the ultimate structure of the striated.

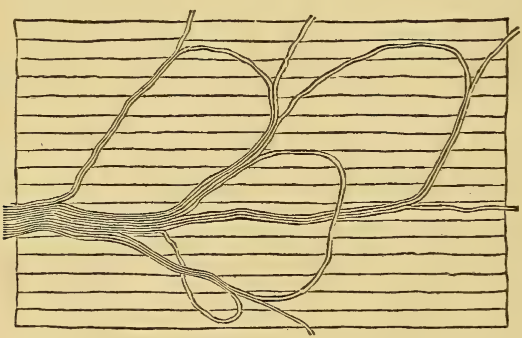
What is the chemical composition of muscular fibre? — This is difficult to determine, on account of its close connection with areolar tissue, blood-vessels, and nerves. According to Berzelius and others, it consists of —

Proper muscular structure....................	15.80
Gelatin (areolar tissue)	1.90
Albumen and hæmatin	2.20
Phosphate of lime with albumen	.08
Alcoholic extract with salts (Lactates).....	1.80
Watery extract with salts	1.05
Water and loss	77.17
	100.00

How are the muscles supplied with blood? — By capillaries, which ramify in the spaces between the fibres. They do not penetrate the myolemma, but are nourished, through the myolemma, by absorption.

How are they supplied with nerves? — They are on the outside of the myolemma of the several fibres; and the ultimate fibres of nerve, after issuing from the trunk, form a series of loops, which return either to the same trunk or an adjacent one. (Fig. 131.) They are motor nerves.

Fig. 131.



Are the muscles of organic life or the unstriped muscles much affected by nervous power? — No; they are stimulated more immediaetly by stimuli directly applied to them.

FUNCTIONS OF MUSCLES.

What is the peculiar function of muscular tissue? — Contractility, or shortening in a particular direction, an endowment responsive to appropriate stimuli, and diminishing or disappearing as the healthy state of the muscle is diminished or destroyed. In contradistinction to elasticity, which is a physical property, contractility is a *vital* one.

What are the two forms of contractility we notice? — Passive, or that inherent property of its tissue by which, when the countervailing

influence is taken off, causes the muscle, or parts of the muscle, to shorten. Extension may be said to be the stimuli to this form of contraction. This has been also called *tonicity*. Active contraction is that which is always excited by a local or partial stimulus; it is partial and interrupted in extent and duration in the voluntary muscles. It requires intervals of rest to recover power lost by fatigue.

What do we mean by stimuli to muscular contraction? — Any agent capable of inducing contraction in the muscles, either naturally or unnaturally applied to them. In the living body, in most instances, the motor nerves are the cause, or the *vis nervosa*, called into play by volition, emotion, and impressions upon the nervous centres, affecting the efferent or motor nerves, independent of volition and consciousness. Injuries and diseases of the motor nerves may act as stimuli. So also heat, pressure, chemical agents, and electricity. There is apparently another stimulus, which affects the hollow viscera to contraction, viz.: distension; but experiment seems to prove that this also is under the influence of the *vis nervosa*.

Is muscular contraction always dependent upon nervous influence? — No; experiments have shown that the fragments of a voluntary muscle, entirely isolated, will contract under stimuli directly applied.

What are the phenomena attending contraction? — Rigidity (proportionate to the intensity of the contractile force). Sound and heat, both probably produced by friction of neighbouring fibres upon each other. Heat is also produced by the disintegration of tissue from use consequent upon chemical changes. Electrical currents are said to be developed by muscular contraction.

What effect has the deprivation of nutrition, either by cutting off the supply of blood and an unnatural temperature, or any cause, upon muscle? — It destroys its contractility.

What do you understand by *rigor mortis*? — The contraction of the muscles after death. If the contractility is great and enduring, the rigor comes on late, and lasts long. Under other circumstances, the reverse is the case. Its cause is obscure, and may be complex; but it bears a strong analogy to the contraction of fibrine after coagulation.

What are some of the apparently more peculiar varieties of muscular movement? — The action of the sphincters, the peristaltic or vermicular movement, slow and progressive; rhythmical actions, as of the heart, which succeed one another after regular intervals of repose, &c.

What is the general law in regard to the arrangement of the muscles upon the skeleton? — Increase of velocity, with diminution of power, the joints acting generally as fulcrums, with the muscles frequently attached near them; and when the opposite extremities of muscles are attached to the adjacent point of two bones, under the influence of stimuli, the movable point is made to contract upon the fixed.

INNERVATION, NERVOUS MATTER, &c.

By what is the function of innervation effected?—By means of the nervous system ramifying through the body. The mind by volition or emotion acts through this system, and conversely an impression made upon certain organs or textures excites mental impressions; thus we have the life of relation established. The nervous system may act also independently of mental influence: any material or physical change in the nervous substance, unconnected with mental affection, is capable of producing action in nerves. In either case the nervous structure must be in a state of integrity.

What is the condition in which we find nervous matter? — In two forms, *vesicular* and *fibrous*; the *vesicular* is gray or cineritious in color, and granular in texture; it contains nucleated nerve-vesicles, and is freely supplied with blood; it appears more immdiately related to the mind in its varied relations. The *fibrous* or *tubular* is mostly white, it is less vascular than the other, and appears to be simply the conductor of impressions. By a mixture of these two forms in some mass or shape we have a nervous centre, the smaller of which are termed *ganglions*, the larger ones are the *brain* and *spinal marrow;* the fibrous threads passing to or from these are termed nerves, which establish means of communication between the nervous centres and various parts of the body, and vice versa. The centres are the sources of nervous power.

What is meant by the cerebro-spinal portion of the nervous system? —The brain and spinal cord, together with the system of nerves connected with it, called by Bichat, the "nerve system of animal life."

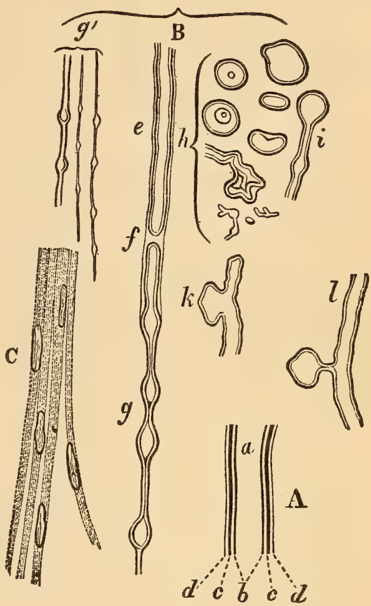
What is meant by the so-called ganglionic or sympathetic system? The double chain of ganglia, with their nerves situated along the spinal columns, and which ramify in a plexiform manner among the viscera, and upon the coats of vessels. This has been called by Bichat, the "system of organic life.

What are the physical and chemical properties of nervous matter? — It is soft and unctuous, easily torn, and supported by other tissues which increase its tenacity. Its softness is due to the large proportion of water in its element—it forming 80 per cent. of its structure, according to Vauquelin; the other components are, albumen, cerebral fat, phosphorus, osmazone, acids, salts, and sulphur. The minimum quantity of phosphorus is found in infancy, old age, and idiotcy; and the maximum of water in infancy.

What are the peculiarities of the fibrous nervous matter? — There are two varieties; the tubular fibre seen generally, and the gelatinous, as seen chiefly in the sympathetic system. The first of these consists of an external delicate membrane, nearly or quite homogeneous, forming a complete sheath, throughout called tubular membrane, within which is an opaque substance, called the *white substance of Schwann*, (Fig. 132,) which forms a tube within the tubular membrane, varying

in thickness, within which again is a transparent material occupying the axis of the tube, called the axis cylinder; the contained substance is soft, and passes by pressure readily from one part of the tube to the other.

Fig. 132.



When a bundle of nerve-fibres is connected together by areolar tissue, what do they constitute? — A nerve.

What is the general position of nerve fibres?—Parallel, and without branching, and without inosculating, excepting where terminal loops are formed in other textures.

What are the peculiarities of gelatinous nerve fibre? — They are flattened, soft, and homogeneous in appearance, with numerous different-shaped and situated cell nuclei, with nothing analogous to the white substance of Schwann, of a grayish appearance, called gray fibres in certain nerves giving this color. They are much smaller in general than the tubular.

What is meant by vesicular nervous matter? — The dark, reddish-gray colored, soft substance, found in nervous centres, but never in nerves, and supplied by a considerable plexus of blood-vessels; its essential elements are cells, generally globular, but varying in size and shape, containing nuclei and nucleoli, the coats of which are a delicate membrane, containing a soft, tenacious, granular mass. In some of the cells we have, exterior to the nucleus, peculiar granular particles, called pigment granules, which give a dark colour to a portion of the vesicle.

What other form of nerve vesicle have we? — The caudate, or that where there are tail-like processes extending from the vesicle. They vary in size and shape; and contain the nucleus and nucleolus in the more simple form, and pigment granules.

Give a general description of the cerebro-spinal nerves. — They are invested with the areolar tissue, called neurilemma, from which passes layers forming partitions between the individual fibres, affording protection to them, and supporting the capillary vessels which afford them nourishment. These blood-vessels are upon the investing sheath and

septa, and are generally derived from neighbouring arteries; sometimes a special vessel accompanies a nerve trunk and perforates it, passing along its axis, as in the great sciatic.

What is meant by the terms *origin* and *termination* of nerves?—They are said to arise in the nervous centre to which they are attached, and to terminate among the various textures to which they are distributed. It is termed cerebral when connected with the brain; and spinal, if from the spinal cord.

What is the general rule in regard to the branching and anastomosing of nerves?—In branching, as it passes from centre to periphery, it breaks into a number of bundles destined to the different organs and tissues to be supplied; before a branch separates, the nerve seems wider above the point of separation, on account of the divergence of its fibres. These branches generally separate at an acute angle, and in some few instances the angle is obtuse or right. In anastomosis they form connections with other nerves by filaments, following their course either back to the centre or to the periphery, instead of following the primary trunk. The simplest form of anastomotic connection is seen in the anterior and posterior roots of the spinal nerves, where they unite after passing through the dura mater, and are bound together as are nerves. Another form of anastomosis exists where nervous loops or arches are formed, the convexities of which are directed towards the periphery, and give filaments to the neighbouring parts, as between the hypoglossal and the cervical plexus.

What are nerve plexuses?—When several neighbouring nerves freely interchange their fibres, as when several nerves proceed from the spinal cord, and a division of each takes place, which eventually become entangled in a mesh, from which certain nerves emerge, composed of fibres derived from several original trunks. The advantage of this arrangement is that we have nerves of different endowments connected, and also, in injury of the spinal cord, a connection is kept up between the part above and below the injury by filaments sent off.

What is the general idea in regard to the termination of nerves?—That those which originate in the brain, and are distributed in the muscles, have no proper termination, but form loops, returning to themselves or joining others from the ramifications of the main trunk, never anastomosing. The fibres which originate in the periphery, and run towards the brain and spinal cord, also form loops in these centres. They also terminate, in some instances, as in the palms of the hand and in the soles of the feet, &c., in small Pacinian bodies—so called after Pacini, who discovered them.

Describe the ganglionic or sympathetic nerves.—The composition is similar to the cerebro-spinal, and consists of nerve fibres bound together by areolar tissue, which is much denser than in the former, which consists of white fibrous tissue, with fine fibres of yellow tissue interspersed. These nerves contain tubular and gelatinous fibres, in different proportions and situations in different nerves, and are pecu-

liar, on account of the frequent formation of ganglia in their course and ramifications. The branches attach themselves to vessels, along which they are conveyed to the tissues. Its ramifications are confined to the head and trunk. It is connected with the brain and spinal cord by the cerebro-spinal nerves.

Describe the development of nerve fibres and vesicles.—The fibres are formed as the muscles, by the coalescence of primary cells into nerve tubules; the vesicular, by a succession of cells.

Is not the nervous structure constantly undergoing disintegration and renewal?—Yes. The former during exercise, the latter during rest; the waste to which it is subjected is represented by the phosphates, as the waste in muscles by the urates in the urine. Hence, rest and a nutritious diet is as necessary for the student as the labourer.

Is nervous matter regenerated?—When a nerve is simply cut across, it will unite; but if a piece of nerve is removed, a peculiar substance takes the place of the nerve: in which, however, true nerve fibres may be developed, though in smaller numbers. Perfect restoration of the action of the nerve does not generally take place, probably on account of the want of proper arrangement of the central and peripheral fibres.

PROPERTIES OF TISSUES.

How are these divided?—Into physical (or those dependent simply upon the peculiar arrangement or mode of cohesion of their constituent particles and chemical constitution, which will manifest itself in the dead and living tissue alike), and vital, (or those which only continue during life.

What are the physical properties?—Elasticity, extensibility, and porosity.

As we are generally acquainted with the first two by their terms, give a general account of porosity, and its peculiar action in the tissues.—This is a property by which the tissues are kept soft and pliable from the watery fluids they contain, or by an attraction for watery fluids.

Is not this property essential to certain vital processes?—Yes.

Is not the process of endosmose and of exosmose intimately connected with the porosity of tissues?—Yes.

Give an example and definition of these terms.—If an animal bladder be filled with syrup, and tightly tied at its mouth, and suspended in a vessel of water, we will find that the bladder is greatly distended by the passage of the water through the membrane; this is termed *endosmose;* and we will also find a small portion of the syrup thus passed through the membrane from the interior: this is termed *exosmose.* The nature of the septum or membrane exerts an important influence upon the direction of the predominent current, as, if the attraction of the septum is greater for the exterior fluid, endos-

mose will prevail, and vice versa. This property of the tissue applies also to gases.

To perform these offices *properly*, must not the tissues be in a state of health and integrity? — Yes.

Are membranes only possessed of this property? — No; we have the same in thin plates of slate and baked clay, though feebler.

Must not the fluids be of different densities, and miscible with each other, and the membrane have an affinity for the fluid, to produce this property? — Yes.

Does endosmose explain all the phenomena of absorption? — No; only of those fluids which require no elaboration: when this is necessary we have a vital process also.

What do you mean by the vital properties of tissues? — Those properties of living beings, by which they form themselves out of materials dissimilar to them, which has been termed a formative or plastic force. This force is effected by three modes: that of development, or the process by which each tissue or organ is originated, or by which it, when incompletely formed, is so altered in shape or composition as to be fitted for a higher function, or is advanced to a perfect condition by growth; where we have an increase in the part by the addition or insertion of materials like those already formed by assimilation; or the continual formation of new follicles in the place of those impaired or removed, thereby preserving the living being in a state of integrity.

What are the other vital properties of tissues? — Contractility, as seen in fibrous tissues themselves; and also when excited by stimuli applied to the nerves which ramify to them. The power of conducting or transmitting stimuli is another property.

What are the essential conditions of formative or plastic force? — Nucleus, derived from the parent, endowed with the force of life, a constant supply of nutritive material, with the nucleus; a certain quantity of water; oxygen as it exists in the air; and caloric in a definite quantity, varying for different genera. Without these life cannot exist — with a modification in these we may have life, but not health.

GENERAL VIEWS OF THE FUNCTIONS OF THE HUMAN BODY.

What do we understand by a function? — According to Carpenter, "In every living structure of a complex nature, whilst we witness a variety of actions resulting from the exercise of the different powers of its several component parts, we at the same time perceive that there is a certain harmony or coördination amongst them all, whereby they are all made to concur in the maintenance of the life of the organism as a whole. And if we take a general survey of them, with reference to their mutual relations to each other, we shall perceive that they may be associated into groups, each consisting of a set of actions

which, though different in themselves, concur in effecting some positive and determinate purpose. These groups of actions are termed *functions.*"

As these can be classified to a certain extent, how are they divided? —Into organic, or vegetable and animal, or those of relation. The former of these are subdivided into that of nutrition, by which the development and structure of the individual is effected, and reproduction. The latter is possessed by animals only, in addition to those appertaining to vegetables, and is dependent upon the nervous system.

Are not the organic and vegetable functions dependent upon each other? — Yes.

What are the organic functions? — The nutritive, including digestion, absorption, respiration, circulation, nutrition, secretion, and calorification.

What are the animal functions? —Sensation, muscular motion, and mental actions.

DIGESTION.

What do you understand by the function of digestion? — The reduction of food to a fluid state for the nourishment of the body. This includes prehension, or conveying the food to the mouth; mastication and insalivation, the chewing or comminuting the food between the teeth, and its admixture with saliva from the salivary glands and juices of the mouth; deglutition, or the act of swallowing, or conveyance of the food to the stomach; chymification, the action of the stomach upon the food, by its various processes, the action of the small intestines, and defecation.

What are the substances which are necessary to the integrity of the system? — Organic and inorganic. The former of these are ordinarily considered as *aliments*, though the latter are also really necessary for the sustenance of the body — such as chloride of sodium in the gastric juice and bile, sulphur in the albuminous tissues, lime in the bones, iron in the blood, and phosphorus in the osseous and nervous tissues.

For what is nourishment necessary? — To form the organism; to supply any losses by decay; to supply the waste engendered by nervous and muscular action; for the purpose of keeping up the calorification of the system, or sustaining the natural temperature of the body.

What circumstances modify the quantity of aliment necessary to the system? — Exercise or rest, heat or cold, age, and any drain upon the system.

Is not a mixed, or vegetable and animal diet, necessary to health? — Yes.

What is Dr. Prout's division of aliments, sanctioned by Carpenter and others? — Into the aqueous, or water, either alone, or holding nutritious substances in suspension or solution; saccharine, compre-

hending sugars, starch, gums, and vinegar (as in vegetables); oily or oleaginous, including the various fats and oils, and alcohol; albuminous, or all nitrogenized substances, as fibrine, gelatine, albumen, caseine, and vegetable gluten (as exists in wheat).

What does Carpenter state in regard to substances which cannot be grouped under either of the preceding heads? — That they are generally of the non-azotized class, as they consist mostly of compounds, in which the hydrogen and carbon are not combined with their full equivalents of oxygen; they become oxidized in the system, and contribute to the heating process, and are excreted in the form of carbon and water.

What is the value of the different kinds of food, as regards the formation of tissues and production of heat? — Where we have the largest amount of nitrogen present, consequently involving the amount of albuminous matter, we can calculate its tissue-forming, or hystogenetic value. On the other hand, when nitrogen is smallest, we have hydro-carbon the largest; consequently, the material for combustion is the greater.

What particular article do we find most adapted, on account of its composition, for the nourishment of the system? — Milk.

What are the essentials to a good form of diet? — That it be sufficient in quantity, and that it contain those principles essential or incidentally necessary to the health of the blood.

Does not the digestive apparatus differ in various animals, according to their habits and their aliment? — Yes.

What do you understand by hunger and thirst? — The want of solid nutriment is termed hunger; and the want of liquid, thirst. Though the former of these is referred to the stomach, and the latter to the fauces, they nevertheless rather show the general wants of the system.

What nerve has been discovered to peculiarly preside over the above sensations?—The *vagus* nerve, by its gastric branches, and the sympathetic nerve distributed to the stomach, has no doubt an influence. We know positively that when the *vagus* has been cut, the sensation is almost entirely obliterated.

OF THE ALIMENTARY CANAL.

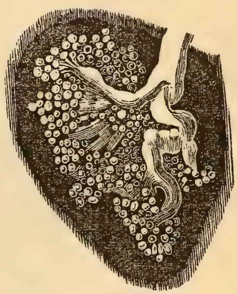
What do you understand by prehension and ingestion? — The conveyance to, and the introduction of food into, the mouth, performed through the agency of the hand, together with the lips, cheeks, anterior teeth, and tongue. These may be considered as voluntary, at least in the adult, though they may be kept up by the guiding influence of the sensations, when the will is in abeyance. In the infant, the act of suction is kept up without the agency of the will, or even consciousness, and may be considered essentially a respiratory act.

What do you understand by mastication? — When food is intro-

duced in the mouth, unless previously in a state to be readily acted upon by the stomach, it undergoes a trituration, or disintegration, by means of the teeth, assisted by the action of the saliva, and fluids of the mouth; during this act the mouth is closed anteriorly and posteriorly.

What is the character and use of the saliva?—This fluid, secreted from the parotid (Fig. 133.) and sublingual glands, and the submaxillary, differs in its characteristics. The former, is clear and limpid, and thin as water, and has a small proportion of animal matter; the latter is thick and viscid, like syrup, with a larger proportion of solid matter. According to Bernard, the flow of saliva during mastication takes place from the parotid and sublingual glands, and is intended to be mixed up with and saturate the food—while that from the submaxillary is the greatest when the food is carried back in the pharynx, and hence appears more adapted to facilitate deglutition. The principal use of the saliva, from recent experiments, appears to be to soften the food.

Fig. 133.

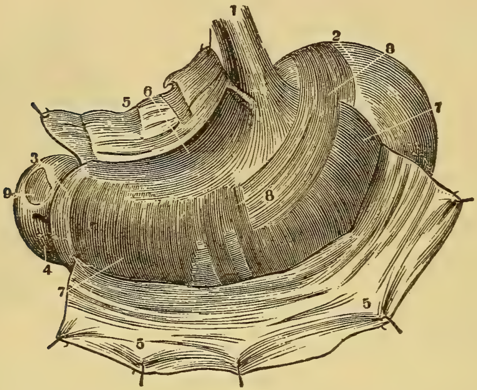


What do you mean by deglutition?—When the food has been sufficiently prepared, it is carried back to the *pharynx*, and thence propelled down the œsophagus into the stomach. The first act in this process is the carrying the food back, and passing the anterior palatine arch, is effected by the approximation of the tongue and palate, and is a voluntary movement. In the second stage, the tongue is carried further back, the larynx drawn forward under its root, and the epiglottis pressed down over the rima glottidis. The muscles of the anterior palatine arch contract after the morsel has passed, and assist its passage back; these, with the tongue, cut off the communication between the fauces and the mouth: the muscles of the posterior palatine arch contract at the same time, in such a manner as to cause the sides of the arch to approach each other like a pair of curtains, nearly closing the passage. From the fauces into the posterior nares, to the cleft between the approximated sides, the uvula is like a valve. The combination of these acts is automatic, though some may be performed voluntarily. In the third stage, the progress of food through the œsophagus is effected by a kind of peristaltic contraction of the tube itself, by means of pressure and the action of the œsophageal branches of the pneumogastric nerve, producing reflex action without sensation. These movements of the œsophagus are involuntary. In vomiting, the action is inverted, &c.

What process does the food undergo after entering the stomach?—It enters in successive waves by a peculiar peristaltic motion of the stomach acting through the fibres of its muscular coat, by which its

diameter is shortened in every direction; the food is thoroughly mixed with the gastric juice, and separates the portions which have been sufficiently acted upon from the remainder. When the stomach is empty, it is contracted, and only dilates to the actual quantity of the food filling it at the time. The respiratory muscles increase the above action. (Figs. 134, 135.) The contraction of the muscular

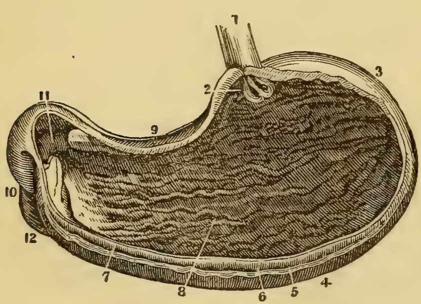
Fig. 134.



fibres extends also to the orifices, especially to the pyloric, during the commencement of digestion.

What are the characters of the gastric mucous membrane and juice? —This is secreted from follicles extensively diffused and making up the greater part of the thickness of the gastric mucous membrane. By a perpendicular section to its surface, we find it almost entirely composed of parallel tubuli, closely applied to each other, with their local extremities against the submucous tissue, and their open ends towards the stomach cavity. In the cardiac extremity they are generally straight and simple, and in the pyloric they are longer and more complicated. Between the tubuli the blood-vessels pass up from the submucous tissue and form a vascular network. On the surface and in the interspaces the orifices of the tubes are seen. The gastric juice

Fig. 135.



thus secreted, when pure, is clear, transparent, and colourless, or slightly yellow, with little viscidity; its specific gravity is not much above water. It has a decided acid reaction, which has been attributed to hydrochloric acid; though more recent experiments seem to prove that lactic acid is the predominating one. Though acid is necessary in the chymifying process, it is not the active agent.

What is this active agent? — Pepsin, first discovered by Wasmann.

What are its properties? — It is a proteine compound in a state of change, and seems to act as a ferment in the same manner as diastase does in the conversion of starch into sugar. It has the power of exciting change in another substance without participating in it itself. It disposes substances to dissolve in the acids of the stomach, forming definite chemical compounds.

How is pepsin obtained? — By digesting the mucous membrane of the stomach in a large quantity of water, at from 85° to 95° F., which separates other matters besides pepsin; but by pouring off this water, and continuing the digestion with fresh water in the cold, very little except pepsin is taken up. It is sparingly soluble in water, and when its solution is evaporated to dryness, we have remaining a brown grayish viscid mass, with the odor of glue, and looking like an extract. When this is dissolved in water, it is turbid, having a portion of the characteristics of pepsin, though greatly reduced. When strong alcohol is added to a fresh solution of it, pepsin is precipitated in white flocks, which may be collected on a filter, and produces a gray compact mass when dry.

What important facts have been developed by experiments upon the subject of gastric digestion? — That it is only when some substance exciting irritation in the stomach, either food or something else, is present, that this acid secretion is poured forth; when empty, the fluid is either neutral or alkaline. The quantity of gastric juice depends rather upon the requirements of the system than upon the quantity of food, and a definite proportion of aliment can only be digested in a given quantity of fluid. In cases of inflammatory action in the stomach, accompanied with dryness of the mouth, thirst, accelerated pulse, no gastric juice can be extracted by alimentary stimulus; drinks are, however, immediately absorbed or otherwise disposed of; over-eating retards chymification. The secretion of the juice is influenced by conditions of the nervous system, as evinced by the effect of mental emotions, checking the process of digestion, and also by the division of the pneumogastric nerve, which, however, only proves that these nerves have an influence on the gastric secretion by the deficiency in its amount after its secretion, &c. The action of the gastric juice is one of chemical solution, and the *vital* attributes of the stomach are only employed in the preparation of the solvent, and in performing those movements which promote its action on the food.

Are all substances equally digestible? — No; as a general rule,

animal food, or azotized substances, are more digestible, and the gastric juice exerts no action upon starchy, saccharine, or oleaginous substances. Sugar is converted into lactic acid while passing along the intestinal tube, and is absorbed, unless too much has been taken, and that for a length of time. When the starch envelopes are ruptured, the substance itself is converted into dextrine and grape sugar. This change takes place, however, more largely in the intestine by its secretions. This class of substances is converted into oleaginous compounds, probably through the influence of the bile. The oleaginous class is not much affected by the stomach, excepting in forming a subdivision and solution, which, by admixture with the pancreatic fluid, form an emulsion more readily absorbed by the lacteals. Proteinaceous compounds are all reduced to a state of solution, and have the properties of albumen.

What effect has temperature upon digestion?—It is of great importance. A heat of from 96° to 100° is necessary to keep up the solvent process. Below this temperature it is suspended; a slight degree above 100°, occasions decomposition. Fluids taken are mostly absorbed, and do not pass the pylorus.

What do you understand by chyme?—The conversion of the soluble parts of solids into a grayish semi-fluid and homogeneous substance with a slightly acid taste and smell, which is creamy in appearance, when the food has been rich, and its consistence varies with the amount of fluid taken.

Of what character is this reduction of food?—A chemical solution.

Does not some gas exist in the stomach during digestion?—Yes, in small quantities; it consists of $O^{11.03}$, $H^{3.55}$, carb. acid$^{14.00}$, and nitrogen$^{70.45}$.

What takes place in the chyme after it has left the stomach?—Though it contains much azotized matter in solution, yet a portion is still held in suspension merely, and requires further elaboration upon entering the duodenum. We have it subjected to the action of the bile, pancreatic fluid, and the secretion from the glandulæ in the walls of the intestine, as those of Brunner, which changes its chemical and sensible properties. By the admixture of the pancreatic fluid with bily or fatty substances, permanent emulsion is formed, and a chemical change has taken place into glycerine and oleic acid, all of which is more readily absorbed in the circulation. When bile and pancreatic fluid are mixed, a new fluid is formed, which, in addition to their own antecedent properties, has the property of digesting azotized substances, which may have passed the stomach.

What other office does the pancreatic fluid perform?—The conversion of starch into sugar, and promotes the digestion or absorption of amylaceous food.

What influence has the bile upon the substances in the duodenum?—This has not been positively ascertained. A portion passes

off, particularly the colouring matter (which would injure the blood if retained), as excrementious matter. Its soapy portion appears to render the fatty matters soluble and more easily absorbed; by preventing the bile passing into the intestine, animals die from inanition. It also appears, from its admixture with chyme, to check destructive chemical changes in its composition.

What then may be stated finally as the use of the fluids in the small intestine? — By a combination of all of them we have a more universal solvent property than possessed by any of them separately. It completes the conversion of starch into saccharine matter; it emulsifies the oleaginous matter; it not only restores albuminous compounds to a state of solution, which may have been precipitated by the addition of bile to the gastric digestion, but it also exerts a solvent influence upon albuminous substances which have not been submitted to the previous agency of the gastric fluid.

As the contents of the small intestine pass along, what change takes place? — They become more consistent, and probably obtain their fæcal odor from being mixed with the secretion of Peyer's glands.

Upon what is the peristaltic motion of the bowels dependent? — Involuntary muscular contraction, excited by the enclosed matter.

What do we understand by defecation? — When the contents of the large intestine are pushed on by vermicular motion, they accumulate in the rectum, where they are retained by the contraction of the sphincter; when they are expelled by the contraction of the muscular fibres of the rectum, excited by the stimulus of distension, and by contraction of abdominal muscles and diaphragm.

How is the quantity of feculant matter determined? — Partly by the quantity and quality of the food, and partly by the quantity of the secretions poured into the canal. If there is in the food a large quantity, which the alimentary cannot reduce and absorb, the feces will be greater. Vegetable food produces a larger quantity than animal. In health, man passes from five to six ounces. If we assume thirty-five ounces as the average amount of food taken in twenty-four hours, it may be inferred that thirty ounces are appropriated to the economy. The cause of the odor of the feces is not satisfactorily determined, but it may be stated that it is not due to the *decomposition* of the *undigested* residue.

ABSORPTION AND SANGUIFICATION.

What do you understand by absorption? — That process by which such substances are taken up and carried into the circulation as are necessary to the nutrition and reparation of the different tissues and organs of the body.

What are the two forms of absorption? — External, or that of *composition*, which appropriates from without the organs the materials for their construction, as in the skin and mucous membranes of

the digestive and respiratory apparatus. Internal, or that of *decomposition*, which takes place from the materials composing the organs, and from the interior of closed sacs.

What are the chief agents in external absorption?—The veins and the chyliferous system. That by the veins is a simple physical operation, depending upon the consistency and miscibility of the blood and liquids to be absorbed, and the rapid movement of the blood through the vessels. The laws of endosmose, before mentioned, seem here to play an important part. Nutritive materials, subjected to the above process, however, undergo the assimilating process which the liver exerts before entering the circulation. Other substances, which require the digestive process, pass through the chyliferous vessels and thoracic duct before entering the circulation.

By what is absorption from the intestinal canal chiefly effected?—By the lacteals, which arise from the intestinal canal, below the point where the biliary and pancreatic ducts open. Each lacteal originates in a villi, by a closed extremity, forming a plexus, by the anastomosis of branches into which it divides, each villus is supplied with a capillary plexus of vessels which lies near its surface. (Fig. 136). The lacteals do not commence by open orifices on the intestinal canal. The lacteals pass between the layers of the mesentery towards its root, anastomosing with one another, and traverse grandular organs, and the mesenteric glands on the right side of the aorta to the receptaculum chyli, or commencement of the thoracic duct, which enters the vena cava where the jugular and subclavian veins unite.

Fig. 136.

What is apparently the peculiar office of the lacteals? — They appear to absorb, more particularly, fatty substances in which albuminous compounds are mixed, as only a very small quantity of fibrin has been detected in the lacteals, near the intestine.

Is it not probable, from the experiments of Matteucci, that oily matters are taken up by the blood-vessels by endosmose? — Yes.

What is the name and characteristics of the fluid in the lacteals? —Chyle. The chyle, as drawn from the larger absorbent trunks, near their entrance into the receptaculum chyli, differs from the fluid as first absorbed, important changes having taken place in its course through glands, &c., to assimilate it to the blood. Albumen in the lacteals, traversing the intestinal walls, is in a state of solution, with no power to coagulate. No fibrin being present, the salts are dissolved, and the oily matter is in the form of variable sized globules. The milky colour of the chyle, according to Gulliver, is caused by a

multitude of minute particles, forming the molecular base of it. As the chyle passes through the absorbents on the intestinal edge of the mesentery, towards the mesenteric glands, it gradually changes; fibrine increases, and albumen and oil, diminishes. In its passage through the mesenteric glands, fibrine increases still more, and the fluid more nearly resembles the blood. The chyle from the receptaculum and thoracic duct, coagulates quickly. The chyle corpuscles are larger than those of the molecular base, and correspond with the colourless corpuscles of the blood, though in an earlier stage of formation.

What is the difference between chyle and lymph?—The chief chemical difference consists in the much smaller proportion of solid matter in the lymph, and the almost entire absence of fat.

By what vessels is internal absorption effected?—The lymphatics.

Give a general description of them.—The lymphatics of the upper and lower extremities form two sets, a deep-seated and superficial, which anastomose, and pass in common to the trunk by the groin and axilla, where numerous glands are upon them. Those of the lower extremities, upon which are numerous glands, are joined by others from the pelvis, loins, and abdominal walls and viscera, and open into the receptaculum chyli by four or six large trunks. The thoracic duct is joined by lymphatics from the left side-walls of the chest, from the heart, and left lung, and empties itself into the great vein, where the lymphatics of the left upper extremity and left side of the head and neck meet it. The lymphatics of the right side of the chest, of the right arm, right side of the neck and head, run towards the junction of the right subclavian and jugular veins, and open into the former by a large, short trunk. They have numerous valves; and have never been found to commence with closed or open extremities, but appear to form a net-work, from which the trunks arise.

What is the aspect of the lymph?—It is transparent, or nearly so, and contains no *molecular base*, as seen in chyle. It contains corpuscles, corresponding with colourless blood-corpuscles; they are variable in amount, as also are the oil globules. It coagulates a colourless clot, being formed inclosing the greater part of the corpuscles. It mingles with the chyle in the thoracic duct.

To what is the movement of the chyle and lymph in their vessels due?—Partly to the *vis à tergo*, and partly to the fibrous coat with which they are supplied. Both the lacteal and lymphatic vessels are supplied with valves, like the veins, preventing the re-flow of the fluid.

By what means does absorption take place from the skin?—By the lymphatics, by imbibition—there being no selection in the fluids.

How are fluids taken up in the pulmonary mucous membrane?—By the veins.

What circumstances influence absorption by the skin and mucous membrane?—When the epidermis is removed, absorption takes place

rapidly; and when the blood-vessels are full and distended, absorption is impeded.

Does imbibition explain all the phenomena of absorption from serous cavities? — No. The lymphatics appear to play a part. The particular laws in regard to endosmose and exosmose, before mentioned, are applicable in this case.

What is the general description of the glands placed on the lacteal and lymphatic vessels?—They are essentially plexuses of the vessels; in addition, most of them contain corpuscles, by which it is probable that the lymph, or chyle, is modified, and its development assisted. Each gland has an investing capsule, with prolongations dipping into its substance. Two or three vessels enter each gland, having only an internal coat and epithelium, called *afferent* vessels; after ramifying in the gland, these vessels unite, and form two or more *efferent* vessels, which, issuing from the gland, receive again their external coat, and proceed to the thoracic duct. No lymphatic or lacteal joins the thoracic duct without first passing through either one or more glands. Capillary blood-vessels are distributed upon the walls of the lymph vessels.

NUTRITION AND GROWTH.

What is meant by nutrition? — Those operations by which alimentary materials, prepared by the digestive process, introduced into the system by absorption, and carried into its most minute recesses by the blood in circulation, are converted into organized tissue.

What is the source and formation of nutrition?—The blood, which affords matter both for renovation and separation.

Does not every tissue appropriate to its own use, by a species of elective affinity, such materials as are necessary for its particular office? —Yes.

How is this effected? — By the parenchyma selecting from the capillaries, &c., those materials necessary to the nutritive process.

Does this selecting power only apply to such substances as are necessary for healthy development? — No. We sometimes find medicines subjected to the same process, as in the case of arsenic, lead, &c.

Upon what does the demand for nutrition arise? — From the tendency to increase, or growth.

Does the evolution of the complete organism, from its germ, consist in mere growth?—No. We must also have development, or a passage to a higher condition of form and structure, so that the part in which this change takes place becomes fitted for some special function, and advances to its more perfect form of its specific type.

What do you understand by hypertrophy and atrophy? — Excess of growth, according to the normal plan of the organ or tissue; atrophy is the reverse of this, without degeneration or alteration of structure.

Is growth confined to the increase of the whole body alone?—No;

we find when an extraordinary amount of functional activity is demanded, that different parts increase, as in the case of muscles which are more exercised than others; so, in regard to the loss of a kidney, the other one may perform double duty.

Does not nutrition make up for the waste and decay continually taking place in the body? — Yes.

Does not nutrition depend, not only upon well-elaborated blood, but also upon the normal condition of the part, and its right measure of "formative capacity," keeping up the likeness and place of those which are effete? — Yes.

Are we certain of the manner of the substitution of new tissue for that which is effete? — No; but we have reason to suppose that it takes place; as in the first development of each tissue. We know that there is a replacement of the effete by healthy and active elements; as in the reproduction of the epidermic and epithelial layers.

Are we certain how effete materials, which have performed their office, are disposed of? — No; but in superficially-nourished tissues, a loss of substance takes place by a gradual exuviation of dead particles in mass. We are not familiar with the manner of the disposition of the worn-out material of the *interstitially*-nourished tissues, as in the nervous and muscular tissue.

Is the formative power dependent upon the nervous system?—No; but it may have some influence in the proper supply and direction.

During what portions of life is nutrition the greatest, and what influences for good or bad may affect it?—It is greatest in youth, and least in old age; it differs in regard to different organs. Depressing emotions, and morbid conditions of the body impede it, while the reverse increase it.

THE BLOOD AND CIRCULATION.

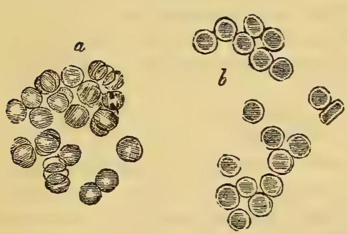
Give a description of the blood. — It is a fluid circulating in numberless canals; among the tissues and organs of the body; colourless, containing red particles; the colourless portion is termed *liquor sanguinis*, consisting of fibrine and serum; and the particles are the blood and lymph corpuscles, and cells. As it flows from an artery, it is of a bright scarlet hue; and from a vein, of a deep purple or modena. The temperature of the blood is 100° to 105° F.; its specific gravity is at 60° F., on an average 1055, water being taken at 1000. In males and robust persons, it is greater than in females and feeble ones. It has an alkaline reaction, and emits an *halitus* or odor, when first drawn, peculiar to the animal from which it is taken.

Is the precise quantity of the blood in the body ascertained?—No. Harvey calculated it at one-twentieth of the body. Haller at one-fifth. Prof. Blake calculates that for a body weighing 144 lbs, the proportion is from 16 to 18 lbs. Todd & Bowman consider that we have no right to infer that the quantity exceeds 30 lbs, and this they consider very high.

When blood is drawn and set aside for a time, we have the separation into clot, or crassamentum, and serum. What is the cause of this phenomena, or coagulation?—The crassamentum is formed by a union of the fibrine and red corpuscles; the latter of which are entangled in the meshes of the former; and the serum or liquor sanguinis is merely deprived of its fibrine.

What is the physical analysis of the blood? — The serum, a straw-coloured fluid, sp. gr. 1025 to 1030, when heated to 165°, becomes nearly solid; proving that it holds a large amount of albumen in solution. It is alkaline, dependent upon free soda, and its carbonate; also, chloride of sodium, phosphate of lime, and magnesia, and probably lactate of soda. It also contains a small amount of fatty matter; it may, however, contain a large quantity in certain forms of disease; and according to Drs. Buchanan and Thomson, it contains it in so large quantities, as to render the serum milky, when the food has been of an oily or amylaceous nature. It also may contain urea, when the kidneys are at fault; and sugar, according to Bernard, when it has been taken largely, or when the liver acts imperfectly. Fibrine has been before described. A pint of blood will yield twenty-nine parts of fibrine. The red corpuscles are cells of a flattened or discoidal form, and in man, of a circular outline; in the human blood, the sides are concave (Fig. 137); according to recent observers, no nucleus is found in the fully-formed disk. During circulation, the red corpuscles are frequently seen to change their form; but this is in consequence of pressure: in passing through the capillaries they sometimes become elongated, bent, or twisted, to accommodate it to the size of the capillary. The diameters of the corpuscles bear no proportion to the size of the animal. In man, the size is, on an average, 1.3200th of an inch; and thickness, 1-12.400th. The colour of the corpuscles is pale, when alone; but when three or four are superimposed, they show a red hue.

Fig. 137.



Of what do the red corpuscles mostly consist? — Globuline and hematine. Globuline is nearly allied to albumen, and may be considered intermediate between it and caseine: it is a proteine compound. Hematine is the colouring matter of the red corpuscles; in its coagulated state, when dried, it is a dark brown, slightly lustrous, mass, devoid of taste and small; is not acted upon by water, alcohol, or ether; acidulated alcohol dissolves it; it is readily dissolved by the caustic alkalies and alkaline carbonates, in water and alcohol. In ultimate composition it has been found to contain iron, which, however, does not give it its red colour. The red corpuscles contain a

large proportion of the gases of the blood. When the red corpuscles float in liquor sanguinis not in motion, they have a tendency to approximate to each other by their flattened surfaces, and to present the appearance of a pile of coin.

Describe the colourless corpuscles.—They are spherical bodies, destitute of colour, their size nearly that of the red corpuscles; under the microscope they do not vary much in the different classes of vertebrata.

VITAL PROPERTIES AND ACTIONS OF THE BLOOD.

How is the life of the blood manifested?—By its coagulation and the subsequent more perfect organization it may attain, when coagulating among healthy tissues. It is shown, however, in a higher degree in its development and self-maintenance, its liability to idiopathic disease and death, and its purpose and relation to other living parts.

Upon what does the regular and perfect performance of the various actions of the blood depend? — The admixture of its principal components in due proportion, and its freedom from deleterious matter.

What are the two constituents of the blood which have been considered *vital?*—Fibrine and corpuscles; the others can only be considered as chemical compounds.

In the development of the blood, what is generally the extent of our researches? — To the corpuscles and fibrine.

What is the first development of the first set of blood corpuscles? — From the embryo cells of the vitelline membrane into nucleated red blood cells; the principal change being the disappearance of granules, the greater prominence of the nucleus, and the acquirement of colour. As the embryo is developing, the lymph and chyle forming, and added to the blood, their corpuscles are developed and supersede the preceding. New blood corpuscles are continually developed from those of the lymph and chyle; new corpuscles never appear produced from the germ of old ones. When a corpuscle passes its perfection it degenerates, and probably liquefies. Every new corpuscle forms itself from the materials of the lymph and chyle, and is perfected in the blood, and the blood is maintained by a repetition of this process.

What has been remarked in regard to the fibrine? — Its development appears to proceed commensurate with that of the corpuscles from the chyle and lymph, and it appears to be perfected in the blood.

Although the two preceding components of the blood are so necessary to its formation, do they answer all the requisites for the proper formation of that fluid for its several offices? — No; the process of assimilation of the new materials must be perfect in every particular to its proper office.

How is the assimilation of the blood probably effected? — By the formative power which it possesses, in common with the solid tissues, assisted by the digestive and absorbent systems, probably the liver and vascular glands; the excretory organs, by which the refuse materials

are separated; and by the balance in the nutritive processes for maintaining the several tissues. Its formative power exists in it as a whole.

What are the purposes of the blood? — To provide materials for the appropritate nutrition and maintenance of all parts of the body; to convey oxygen for the discharge of its functions, and for combination with their refuse matter; to bring from the same parts those refuse matters, and to convey them where they may be discharged.

What is the appearance of the white corpuscles? — They present different aspects, according to the period of development; they are firmer than the red, and do not coalesce; in circulating they occupy the outer border of the current, while the red are seen in the centre. The proportion of the white to the red is very small in health — one to fifty.

What are the chemical constituents of the blood? — Fibrine, albumen, red corpuscles, water and salts, extractive matter and fats.—[See *Bernard & Robin.*]

What are the peculiar fatty matters in the blood? — They are saponifiable fats in the human subject, margarine and oleine, phosphorized fat—an essential constituent of the corpuscles—cholesterin, which is constant, and serolin, very minute in quantity. The odour of the blood probably depends on a volatile fatty acid; an addition of sulphuric acid increases this odour.

What is included under the term extractive matter? — This is very vague; it generally includes either those histogenetic elements which are undergoing progressive metamorphoses, or non-azotized alimentary matter, or products of the retrograde metamorphosis of the tissues, which are on their way to the excretory organs.

What are the principal inorganic constituents in the blood? — The phosphate and carbonate of soda, and phosphate of lime. It is probable that the alkalinity of the blood depends upon both the salts of soda mentioned.

What are the modifying influences in the constitution of the blood? — Age, sex; the male being richer in solid contents, and especially in corpuscles, peculiar temperament and constitution, the previous ingestion of food and drink, and the diet habitually used; an animal diet increasing the solid matter and corpuscles, while a vegetable diet lowers the whole amount of solid matter, with reduction of corpuscles, but increase in albumen; complete abstinence from food, or insufficient supply, reduces the whole solid matter; loss of blood has an effect similar to abstinence; it diminishes the amount of red corpuscles, but not of fibrine.

What is the difference between arterial and venous blood? — Upon this there is much difference of opinion, excepting as regards colour, which is dark red in the veins, and bright scarlet in the arteries. Arterial is one or two degrees higher in temperature than venous. The solid materials in the arterial are probably greater than in the venous blood. The greatest difference, however, according to late ob-

servers, is the amount of free gases they contain; oxygen being in larger proportion (by volume) in arterial than in venous blood; carbonic acid is larger in venous blood (by volume) than in arterial; the amount of nitrogen varies, their being no constant difference. Blood drawn from any part of the arterial system is alike; not so with venous blood, as the blood from the vena portæ differs from the blood of the hepatic vein, and both differ from the blood of the jugular, so also the blood from the splenic, renal, &c.

THE HEART AND CIRCULATION

What do you understand by the circulation of the blood? — That process by which the blood is carried by a special apparatus through every portion of the body, affording at the same time materials for the growth and renovation, together with a supply of oxygen requisite to vital action in the organism, and to carry off the particles set free by the disintegration of the tissues, which are to be removed from the body.

What constitutes this special apparatus? — The heart, arteries, veins, capillaries, and, co-ordinately, the lungs. This is termed the vascular system.

By whom was the circulation discovered? — By William Harvey, in 1619.

Describe the heart.—It is a hollow muscular organ, varying in man and animals according to the complexity of the circulation. In man it is situated in an oblique position, on the left side of the thorax, and has four cavities, two auricles at the base, and two ventricles, going to form the apex. An auricle and ventricle are on each side of the median groove. The ventricles are cone shaped, and the auricles derive their name from an appendage similar to a dog's ear. When the ventricles are laid open, we find a communication called *auriculo-ventricular orifice*, by which blood passes from the auricle into the ventricle, and a funnel-shaped channel, infundibulum, which leads to the artery, whence the blood is propelled from the ventricle. Two large arteries spring from the base of the heart in front—the aorta from the right ventricle, and the pulmonary from the left.

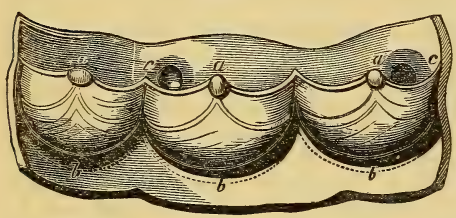
What are the valves of the heart? — On the left side, at the auriculo-ventricular orifice, we have two triangular curtains, called the mitral valve and the mitral orifice, to which are attached *chordæ tendineæ*, which pass to various points of the wall of the ventricles. In the right side, at the *auriculo-ventricular orifice*, we have a valve consisting of three portions, each having a pointed pre-extremity, from which spring also *chordæ tendineæ*, and is called the *tricuspid valve*. At each of the arterial orifices we have three semilunar valves, to prevent regurgitation of blood into the ventricles.

What is peculiar in regard to the auricles? — They are thin-walled, muscular, irregular cavities, divided by a thin septum, which,

in intra-uterine life, contain a small orifice by which they communicated (*foramen ovale*, or *Botalli*); they each communicate, as said before, into its proper ventricle. They have two distinct portions—the sinus venosus, and the proper auricle. The veins open into the sinus venosus, and not into the auricular appendages. The right auricle receives the superior and inferior vena cava and the coronary vein. On laying open the right auricle, we find an interlacement of fleshy bundles, called *musculi pectinati*. We also find the Eustachian valve of intra-uterine life, projecting between the vena cava and auriculo-ventricular orifice, which in the fœtus served to direct the ascending blood through the foramen ovale into the left auricle. A small valve also exists at the orifice of the coronary vein, called valve of Thebesius. In the left auricle, the right and left pulmonary veins empty. Very few *musculi pectinati* are in the left auricle; its surface is smooth, and covered with an opaque membrane.

What is the structure of the valves of the heart?—They are formed by processes of fibrous tissue, covered by epithelium. (Fig. 138.)

Fig. 138.



What is the mechanism of the valves?—They are closed by the hydraulic pressure of the blood. As the blood presses against the valves, they come in contact, and would be thrust into the orifices, where it not for the *chordæ tendineæ* inserted into their margins and the walls of the ventricles. When the ventricles contract, the chordæ are drawn tense, and the valves consequently closed, preventing regurgitation. The semilunar valves are closed by the pressure of the blood from the artery, backwards towards the heart.

What is the character of the muscular tissue of the heart?—The fibres are of various sizes, resembling the striped fibres of the external muscles, and interlace in an intricate manner, adding greatly to the power of resistance in the organ. The muscular fibres of the auricles are divided into a common and proper set. At the venous orifices, a series of circular sphincter-like fibres, are visible.

How is the heart nourished?—By blood derived from the aorta; from the right and left coronary veins.

What are the nerves of the heart?—They are derived from the cardiac branches of the pneumogastric and the sympathetic, which together form the cardiac plexus; the superficial plexus corresponding to the concavity of the arch of the aorta, and the deep-seated plexus behind the arch of the aorta. A ganglion, called *ganglion*

cardiacum Wrisbergii, after the discoverer, is generally found in front of the left auricle and behind the aorta. Other nerves and gangliæ have recently been discovered.

By what is the heart inclosed?—By a fibrous bag; the fibrous pericardium adherent below to the tendon of the diaphragm, and above becomes continuent with the areolar tissue which invests the large arterial and venous trunks connected with the heart. This bag prevents displacement of the heart. Lining this fibrous bag, we have a serous membrane, which is also reflected over the heart.

What lines the cavity of the heart?—The endocardium—a membrane continuous with and resembling the lining of the arteries and veins, which consists of a delicate epithelium placed upon a stratum of fine wavy fibres. The endocardium of the left auricle, and of the septum, and auricular appendage, is denser than in other parts of the heart.

What is the weight of the heart?—According to Reid, eleven ounces in the male, and nine ounces in the female.

What do you understand by the action of the heart?—That rhythmical motion of the heart, by which the successive contractions and dilatations of the muscular walls of the four cavities propel the blood. The auricles contract simultaneously, and so also do the ventricles, and dilate simultaneously also. The contractions of the one pair of cavities are alternate with the dilatations of the other.

What name has been given to designate contraction and dilatation?—The former is termed *systole;* the latter, *diastole.*

Is not this power of contractility, or irritability, peculiar to the heart itself?—Yes. This has been proved by observations upon the heart, when its connexion with the nervous system has been cut off; also by the fact of its continuing when it is empty, and further by its continued action when *in vacuo.*

What influences have the auricles and ventricles in the circulation?—The auricles are more properly reservoirs, and have little influence in propulsion. The *systole* of the ventricles is concordant with the propulsion of the blood into the arteries, causing the pulse. The *diastole* coincides with the collapse of the arteries.

What prevents regurgitation of blood from the ventricles into the auricles, during the contraction of the ventricles?—The tricuspid valve on the left side, and the mitral valve on the right side of the heart. The closure of the tricuspid valve is, however, not always complete, and then regurgitation may slightly take place, which may be salutary to prevent an overloading of the vessels of the lungs. This has been called a *safety-valve action.*

What prevents the blood from flowing back from the aorta and pulmonary artery, during the dilatation of the ventricles?—The semilunar valves.

What marks are there distinguishing the dilatation of the ventricles?—The first succeeds their systole when the apex of the heart

recedes from the walls of the thorax. The second is synchronous with the auricular contractions, and the heart is enlarged in all directions. Between these the interval of repose takes place.

What is meant by the heart's impulse? — The thump given by its apex against the walls of the chest; at this time the *diastole* of the heart takes place.

What is now generally understood by the sounds of the heart? — By placing the ear over the heart, we hear first a heavy, somewhat prolonged sound, coinciding with the second stage of ventricular dilatation, the contraction of the ventricles, the pulse in the arteries, and the impulse of the apex of the heart. The second is a short, clicking sound, coinciding with the dilatation of the ventricles.

Are the causes of the sounds of the heart yet definitely settled? — No. The prevailing opinion is that the first sound is produced by the rush of blood through the orifices of the aorta, and pulmonary artery, and auricular ventricular opening, also the passage of the blood over the rough internal surface of the ventricles, the muscular contraction of the heart, and the impulse of the heart against the thorax. The second sound is produced by the closing of the semilunar valves at the orifices of the aorta and pulmonary arteries.

What is the duration of the sounds of the heart? — The first is double that of the second, and the second equal to the pause. If we divide the whole period into four parts, we have the first two sounds occupying the first part, the third the second, and the fourth the pause.

Give a general account of the capacity of the heart, its force, and different modifying causes, &c. — Each cavity will contain about two fluid ounces; the right auricle and ventricle are most capacious, and the left have thicker walls, particularly the left ventricle, on account of the duty it has to perform. The contractions of the heart are from seventy to seventy-five in a minute; at birth it is much more frequent, and diminishes towards the close of life. Age, sex, temperament, mental emotions, influence it—in the female it is more frequent than in the male; after eating it is increased, likewise in the morning, &c. The quantity of the blood has been estimated *rather too low*, as one-fifth of the weight of the body. The force of the blood is calculated at about thirteen pounds.

Having described the functions of the heart in the circulation, now describe the course of the circulation in the adult. — Commencing with the left ventricle, the blood is forced into the aorta, where it is distributed to all the arterial system, excepting the *pulmonary artery*, passing through the capillary system to the venous radicles, into the venous trunks, which empty into the vena cava ascendens from the lower part of the body, and the vena cava descendens from the upper part of the body, both of which empty into the right auricle of the heart. This is termed the systemic, or larger circulation; the blood in this system does not enter the lungs. After the blood has passed from the venæ cavæ into the right auricle, it passes into the right ventricle,

whence it is driven through the pulmonary artery (which, it will be perceived, carries venous blood,) to the lungs, and to the pulmonary veins, after which it passes into the left auricle, through the auriculo-ventricular orifice, into the left ventricle. This is termed the lesser, or pulmonic circulation, traversing only the lungs, and connecting the right ventricle and left auricle.

THE BLOOD IN THE ARTERIES, VEINS, AND CAPILLARIES.

Describe the arteries. — These vessels, which convey the blood from the heart, are cylindrical tubes, composed of three coats, an external cellular, a middle muscular fibrous, composed of muscular fibres and yellow fibrous elastic tissue, and an internal serous. The external coat is the medium of connection with neighbouring structures, and affords a nidus for the nutrient blood-vessels of the arterial walls (the vasa vasorum). It is the most important tunic for the integrity of the artery. The middle coat consists of an internal portion, yellowish in colour, composed of longitudinal fibrous tissue disposed in two planes, and an external grayish portion of the middle coat, which is distinguished by transverse fibres, which surround the artery at right angles to its long axis. The muscular fibres are mixed up with the preceding unstriped muscular fibres and with oval nuclei, with their long axis at right angles to the arterial canal. The arteries generally come off at an acute angle with the continuous trunk, excepting in some of the intercostals and lumbar, where a right angle is formed with the aorta.

What do you remark in relation to the anastomosis of arteries, or when different arterial trunks communicate indirectly? — This is a most important provision, by which the circulation is kept up in parts, when the principal artery has been obliterated. We have three principal forms of anastomosis; 1st. Where a union takes place of two arteries from different trunks, to form one. 2d. Where two vessels from the same or different trunks form, by their union, an arch, from the convexity of which others come off, forming similar reunions. 3d. Where two neighbouring arteries communicate by a distinct vessel passing from one to the other. These various forms of anastomosis serve, either to answer the purpose before mentioned, or to distribute the blood more equally through different parts of the body, and take off the impetus from a too large volume of blood, and in addition to this, in membranous expansions, a large number of smaller branches anastomose, forming a continuous plexus, from which the ultimate capillaries are given off.

What is the course of the pulse in the artery? — With every contraction of the ventricle, blood is forced against the elastic walls of the artery, which gives that sensation we call the pulse, which is nearly synchronous with it, and a little later than the beat of the heart. There is normally no pulse in the veins and capillaries.

In addition to what has been referred to in regard to the coats of the arteries, what important offices does the middle coat fulfil? —The middle coat, by its elasticity, preserves an equal and continuous flow of blood, which otherwise, from the heart's action, would be jerking or interrupted by its contractility, and the flow towards particular organs is regulated; this is seen more clearly at a distance from the heart, where the action of the heart is fully felt. In addition to this, it regulates the diameters of the tubes, as the supply of the blood is more or less required. Where permanent enlargement, however, is necessary, we have an increased nutrition in the walls.

What is meant by *tonicity* in arteries? — That inherent property of slow contraction, distinct from elasticity, apparently dependent upon vital contractility, as seen in the empty condition in the artery after death.

Describe the venous system. — The veins carry the blood back from the various tissues and organs to the heart. They commence by small radicals in the tissues and organs, and uniting, form larger ones; and so on, till they unite and pour the blood into the venæ cavæ. They are more numerous and capacious than the arteries. They are divided into superficial and deep-seated. When distended, they are cylindrical, with knotted appearances, caused by an enlargement at the valves, which prevent a reflow of blood. The coats of the veins are essentially like those of the arteries, though less developed; the elastic property being deficient, they easily collapse. The valves are composed of the longitudinal fibrous coat of the vein, covered by a layer of epithelium. They are semi-lunar and concave at their border, disposed in pairs, in juxtaposition. Sometimes there are three placed together. The valves are more numerous in the superficial veins and those of the lower part of the body. The smallest veins, and the cavæ, the pulmonary, those of the liver and the portal system, the splenic, mesenteric, and renal veins, are devoid of them.

Upon what is the circulation in the veins dependent? — Upon *vis à tergo*, the suction property of the heart, and the rushing of the blood towards the chest, to supply the effect of the downward pressure of the diaphragm. This latter opinion is hypothetical. Muscular contraction and movements have also an important influence.

What is there peculiar in the pulmonary circulation? — *Venous blood* is sent from the heart through the pulmonary *artery* to the lungs; an example of an arterial tube carrying venous blood; — and arterial blood is conveyed to the heart by venous tubes.

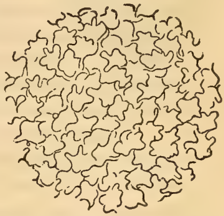
What is peculiar in the portal circulation, and that of the kidney? —In both of these the blood passes through two subsystems of capillaries after leaving the arteries. In the case of the liver, the blood, after leaving the intestinal arteries, passes through the intestinal capillaries into the intestinal veins, to the trunk of the vena portæ, which transmits it to the hepatic capillaries, thence to the hepatic veins,

whence it reaches the cava, or systemic veins, by several points of communication. A portion of the circulation, of which the chief vessel is formed like a vein, distributes its blood like an artery, and is called the portal circulation. In the kidney, the afferent arteries end in malpighian tufts, whence the blood is taken up by the efferent veins, which, breaking up like arteries into another capillary plexus surrounding the uriniferous tubes, gives origin to the radicles of the renal or emulgent veins.

Is the portal circulation under the influence of the heart's pulsation? — No. This, together with the visceral circulation, generally depends upon the pressure of the abdominal walls and respiration.

Describe the capillaries. (Fig. 139.) — They are the system of vessels, minute in size, intermediate between the arteries and veins. They form a net-work in each tissue or organ, and from which each organ or tissue derives nourishment. Their size is in proportion to that of the red particles of the blood, and vary in diameter from $\frac{1}{1000}$ to $\frac{1}{5000}$ of an inch; they are direct minute communications between the arteries and veins. Membranous parietes are now generally supposed, from recent observations, to exist.

Fig. 139.



Upon what is the circulation in capillaries dependent?—It is maintained by the *vis à tergo* of the heart, regulated and modified partly by the elasticity and contractility of the walls of the capillaries, but chiefly by the operation of a force developed in those chemical and physical changes which take place between the blood and the tissues, in which the phenomena of nutrition essentially consists. In this case we must have both a normal condition of the blood and the tissues.

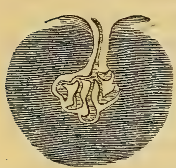
What is the physical principle announced by Dr. Draper, of New York, in relation to the circulation of the sap in plants, which accounts also for the changes of the blood in the capillaries? — That if two liquids communicate with one another in a capillary tube, or in a porous or parenchymatous structure, and have for that tube or structure different chemical affinities, movement will ensue; that liquid which has the most energetic affinity will move with the greatest velocity, and may drive the other liquid entirely before it. (See Todd and Bowman, p. 696.)

Does not the nervous power sometimes exert an influence over the diameter of the blood-vessels, as seen in the functions of secretion and nutrition? — Yes. We also see its influence in blushing, and in the erectile tissues.

What do you understand by erectile tissues? — Examples of these are found in the corpora cavernosa, and corpus spongiosum, penis, the clitoris of the female, and less in degree in the nipple, when, under

ordinary circumstances the parts are flaccid, but at other times receive an extraordinary amount of blood, and become distended or swollen. They appear to consist of a plexus of veins inclosed in a fibrous envelope, traversed by numerous contractile fibres, by which an obstruction is offered to the reflow of blood by the veins: hence their turgescence. Müller describes a peculiar arrangement of the arteries in the corpora cavernosa penis; the one affording nourishment to the organ, the others coming off, and going to the venous cells. (Fig. 140.) Erection may be caused by local irritation, and emotions of the mind; the nerves interested are the pudic and the sympathetic. The most perfect form of erection only requires the muscles to compress the veins.

Fig. 140.



What is there peculiar in the cerebral circulation?—On account of the functions of the brain we have an increased supply of blood necessary, which is accomplished by the two internal carotids and the two vertebrals; in order that the supply should be less influenced by external circumstances, the arteries are tortuous, and the large anastomosis of the circle of Willis is provided. The transit of the large arteries through the carotid canal in the temporal bone prevents overdistension. The supply is also modified by the distribution of the arteries on the pia mater, whence we have a free anastomosis before the blood-vessels enter the substance of the brain. The veins of the brain are so arranged as to allow of scarcely any change of size; they are not compressible by any change the fulness of the arteries may exert. From what has been said, it was the opinion of some that the quantity of blood in the brain must always be the same; this has been disproved by Dr. Burrows.

RESPIRATION.

What do you understand by respiration?—That function by which the blood, after performing its offices in the economy, and being returned by the venous system to the heart, is changed by passing through the lungs, by contact with atmospheric air, or air dissolved in water, into arterial blood; carbonic acid gas being given off, and oxygen taken in the system, through the medium of a membrane which allows the diffusion of gases.

Whence is the carbon of the blood derived?—From the decay of the tissues common to all organized bodies, which is favoured by all that promotes their vital activity, and retarded by every influence that depresses it. From the change peculiar to nervous and muscular tissues, which is the very condition of the production of their power, and from the direct conversion of the carbon and hydrogen of the food into carbonic acid and water, which is peculiar to warm-blooded animals, and varies with the amount of heat to be generated.

Are not all respiratory apparatuses formed upon the same general plan? — Yes; being prolongations of membranes from the external surface, they are adapted to bring the blood in contact with the surrounding medium. In aquatic animals we have *gills*, or tufts, prolonged externally, supplied with arteries and veins; when the change in the blood takes place in air-breathing ones, the membrane is reflected internally, upon which the capillaries are distributed.

What is the situation of the lungs in man? — They are placed in the thoracic cavity, and receive air through the nasal passages and trachea, and venous blood from the right side of the heart. They are a double organ with a single tube, and the heart lying between the right and left lung, and a single common pulmonary artery supplying venous blood. The lungs are adapted to the cavity in which they are lodged, and are invested with a serous membrane, which also lines the walls of the thorax, and dips in between those fissures which divide each lung — the right into two, and the left into three *lobes*. The trachea descends from the larynx in the middle line, which divides into the right and left bronchus; the right being shorter and wider, and more horizontal — the left, larger, to pass under the arch of the aorta. At the root of the lung, each breaks up into more or less minute tubes, which are distributed to the more intricate structure of the lungs.

What is the course and distribution of a bronchus? — At first it is more or less cartilaginous; it then loses its cartilaginous structure, but retains its circular form, without air-cells opening into it; afterwards we find air-cells opening into it largely, and then finally the air-cells are so numerous, and open so frequently, that it loses its circular character, and is reduced to an irregular passage, running between the cells, and reaching the surface of the lobule, ends by forming a terminal cell.

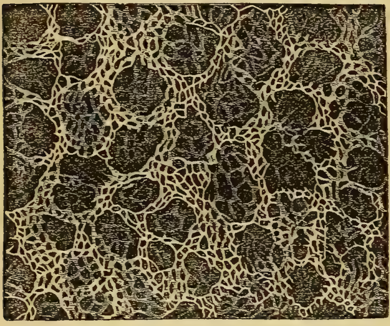
What is the structure of the air cells, their appearance, and how do they communicate with the bronchi? — The walls of the air cells are formed of a thin and transparent membrane, folded sharply at the orifices of communication, and forming a definite border, lined by an epithelial layer, fibrous in structnre. The air-cells are small irregular-shaped cavities, usually four or five-sided; those situated nearest to a bronchus open into it, and those next into the previous air-cells. 17,790 air cells have been calculated as grouped around each terminal bronchus, and the total number 600,000,000.

How is the capillary plexus disposed relatively to the air cells? — Between the two layers which form the walls of the two adjacent air-cells, so as to expose one of its surfaces to each, (Fig. 141,) by which provision the full influence of the air upon it is secured. One terminal branch of the pulmonary artery supplies the plexuses of several cells.

Does there appear to be any power of vital contractility in the lungs? — No; their elasticity, however, prevents their being altogether passive agents.

As the lungs fill the cavity of the thorax when dilated by air, what is the effect of a large external opening into the cavity of the pleura?—The lungs collapse from the external air rushing in.

Fig. 141.



How long does the development of air cells continue? — According to Bourgeny, till thirty years.

What do you understand by the respiratory movement? —That movement by which air is taken into the lungs, (or *inspired,*) and afterwards expelled, (or *expired,*) after being changed by the respiratory process.

What are the phenomena in inspiration? — The pleural cavity is dilated chiefly by the contraction of the diaphragm, which, from the high arch (which it holds when the lungs are passive), becomes nearly a plane — by this pressure is exerted upon the abdominal viscera so as to cause them to protrude. In ordinary respiration the diaphragm acts almost alone; but in more active respiration, the cavity of the chest is dilated laterally, antero-posteriorly, and inferiorly, by the elevation of the ribs. The number of inspirations in a minute is generally from fourteen to eighteen.

What are the phenomena in expiration?—In tranquil respiration this appears to be a mere reaction from the previous dilatation, assisted by the elasticity of the cartilages of the ribs, of the bronchial tubes, and the elastic tissue investing the lungs, and that of the air cells.

What is the capacity of the lungs for air? — This varies in different individuals. Mr. Hutchinson, who has experimented largely on this subject, says we must understand by this term the greatest amount of air we can force out of the lungs by the greatest voluntary expiration, after having first taken the greatest voluntary inspiration. He also says that in health the capacity bears a constant relation to the height of the person, and the expiratory force is one-third greater than the inspiratory.

Is the quantity of air taken into the lungs by the deepest possible inspiration, a measure of the quantity the lungs ordinarily contain?— No; we have residual air, constantly remaining in the lungs while they retain their natural structure, over which the most violent expiration has no control; supplemental air, that portion which remains after a gentle ordinary expiration, and can be expelled at pleasure; breathing air, the ordinary volume displaced by ordinary respiration; complemental air, that which we can forcibly inspire, over and above that in ordinary inspiration.

What is the total amount of air which passes through the lungs in twenty-four hours? — This varies under various circumstances. Mr. Coathupe's estimate is 366⅓ cubic feet.

What effect have the nerves on respiration? — The action of respiration is partly voluntary and partly involuntary. The medulla oblongata is the source of nervous influence in respiration; and the spinal cord, the trunk from which the nerves arise. If the medulla oblongata is destroyed or much impaired, respiration ceases at once. If the spinal cord is cut above where the dorsal nerves are given off, the motions of the ribs and abdominal muscles are paralyzed; but the other respiratory movements continue. If the spinal cord is cut above the origin of the phrenic nerve, the diaphragm is paralyzed, while the nerves, coming directly from the medulla oblongata, still continue their office. The reflex system of nerves preside over the action of the respiratory muscles. The afferent nerve, or principal excitor, is the par vagum and sensory branches of the fifth pair; the former communicating impressions from the lungs, the latter from the general surface.

What is the composition of the atmosphere we breathe?—Oxygen, nitrogen, carbonic acid, and watery vapour.

What are the effects upon the air in its passage through the lungs? — It is warmed; its carbonic acid is increased; its oxygen is diminished; its watery vapour is increased.

What is the temperature of the expired air? — In most climates it is hotter than the inspired, varying from 97° to 99½°; it nearly acquires that of the blood before being expelled from the chest.

What is the quantity of carbonic acid exhaled, according to numerous experiments?—This is liable to many variations; the mean, however, is 160 grains of carbon per hour in a well-formed adult man, or as an average for 24 hours, 3840 grains, or 8 oz. Troy.

What are the chief causes of variation?—Temperature of surrounding medium. Carbonic acid in warm-blooded animals is increased by cold, and diminished by heat. Age.— It increases in both sexes to about the 20th year, is stationary to about the 45th, and diminishes. Sex.— In all ages beyond 8 years the exhalation is greater in males than females. It increases proportionately about alike to puberty, and in females it remains stationary during menstrual life; after which it augments, and then decreases as in men. If menstruation temporarily ceases, it is increased; in pregnancy it is increased. Development of the body.—In more robust individuals and with greater muscular development, it is increased. State of health or disease.—This is generally obvious; in the exanthemata it is unusually great, in typhus it is said to be diminished, &c. Muscular exertion or repose.— Bodily exercise in moderation increases it, but if prolonged to fatigue it is diminished. Sleep or watchfulness.—It is less when sleeping than when awake. State of digestive organs. — It is increased by eating and the reverse. Period of the day.—It is increased before and after noon, and diminished before and after midnight.

What becomes of the nitrogen of the air? — A small portion only is absorbed, from the difficulty of its passage through the animal membranes.

What is the cause of the change in colour of blood as it passes through the lungs, viz.: from a modena or dark crimson to bright scarlet arterial? — This is a physico-chemical process; the cause is still doubtful; Liebig stating that the iron in the red corpuscles is the cause; others, from a change in form of the corpuscles themselves, deny that the iron has anything to do with it. Saline matters have been considered as a necessary ingredient in the blood, to cause the oxygen to produce its usual effect.

Is not exhalation and absorption continually taking place through the lungs?—Yes; in addition to the gases a large addition of watery vapour to that inspired is driven off; and taken from the blood, ranging from 16 to 18 ounces in 24 hours. The watery vapour contains carbonic acid and animal matter; volatile matters are absorbed from the air; and, according to Dr. Madden, under peculiar circumstances fluids may also be.

What are the effects of a suspension or deficiency of respiration? Asphyxia, or a cessation of muscular movement and circulation, with an accumulation in the venous system. The first effect is a retarded movement in the capillaries, accumulation in the veins, and a deficient supply in the arteries. The time necessary to produce these changes differs in different animals, and in different states of the same. Warm-blooded are sooner asphyxiated than reptiles or invertebrata. Many persons may be deprived of air from 2 to 3 minutes, and live. The effect upon the heart is overdistension on the right side, and want of stimulus on the left. If asphyxia has not been too long, artificial respiration and the introduction of oxygen, will set in motion the pulmonary circulation.

Is not the repeated respiration of the same air, though originally pure, of great injury to the constitution?—Yes; it becomes charged with carbonic acid, without oxygen being admitted to properly change the blood.

ANIMAL HEAT, &c.

Is not the production of animal heat in warm-blooded animals, as necessary for life as the elimination of carbonic acid and the absorption of oxygen?—Yes.

What is the average temperature of the human body?—From 98° to 100°.

Do we know the source of heat in the body?—Not positively; that it is an organic function, we have reason to believe, from the fact that plants generate an amount of it, and particularly at the germinating and flowering period.

What appears to be a well-established fact? — A close and exact

conformity between the amount of oxygen consumed and carbonic acid given off, and the degree of heat liberated.

What may be stated generally in relation to the evolution of heat? —That every change in the condition of the organic compounds of the body, where their elements enter into new combinations with oxygen, must be a source of the development of heat.

Has not the nervous system exerted an influence in the evolution of heat?—Yes.

Is the power of germinating heat in the human body equal in degree at all ages? — No. The younger the animal, the weaker it is, the less is its calorifying power. A decrease in calorifying power also takes place in advanced age.

What are the means by which the temperature of the body is prevented from being too high? — By the evaporation which takes place from the surface of the body; also by the amount of watery fluid secreted by the glandulæ of the skin, this amount depending chiefly upon the temperature of the surrounding air. Thus when the external heat is very great, a large amount of fluid is poured out, and this evaporating, carries off a large quantity of free caloric, which would otherwise raise the temperature of the body. If the atmosphere is hot and dry, we have exhalation and evaporation freely going on; if hot and moist, we have exhalation without evaporation.

Are there not some rare instances where luminosity or light has been emitted from the body? — Yes; this has been attributed to the production of a phosphorescent compound.

Do not experiments seem to prove that an electrical state exists in the body? — Yes; Matteucci, Du Bois Raymond, &c., have devoted much attention to this subject, and by careful search, and the most delicate instruments, have made some curious developments.

SECRETION AND EXCRETION.

What do you understand by these terms? — By secretion we mean that process by which materials are separated from the blood and from the organs in which they are formed, either for some ulterior purpose in the economy, or of being discharged from the body as *excrement.* In the former case, both the separated materials and the processes for their separation, are termed secretions; in the latter they are termed excretions.

In what does the essential character of true secretion exist? — Not so much in the process itself, as by the position where cells are developed, and the mode in which their products are disposed of. In secretion we have a constant production of cells and their exuviation, which minister to it. Each group of cells is adapted to separate a production of some particular kind, which constitutes its special pabulum.

What does every secreting apparatus possess as essential to its

structure? — A primary or basement membrane, certain cells, and blood-vessels. They may be classed under two principal divisions—membranes and glands.

What are the principal secreting membranes? — The serous and synovial, mucous membrane, and the skin.

What are the characteristics of the secreting glands? — They appear to be more immediately connected with this office. Their general plan of structure is peculiar in regard to the arrangement of the cells which line their tubes or cavities, as an epithelium, and elaborate as secreting cells. As these cells are arranged in different forms, and the manner in which their contents are discharged, so we arrange the several varieties of glands.

What are the various forms of glands? — We have first the most simple, a single primary vesicle, or sacculus, containing cells and nuclei. These constitute temporary glands, or glands without orifices, as Peyer's glands. Second, the glands, with permanent ducts, which are divided into the simple tubular glands, as in the tubular follicles in mucous membranes and gastric glands, sudoriparous glands of the skin, and the meibomian follicles beneath the palpebral conjunctiva. Aggregated glands, as the mucous glands in the trachea, vagina, and minute salivary glands, the tonsils, lachrymal, large salivary, Brunnian, mammary, Cooper's and Duverney's, pancreas and prostate. Third, convoluted tubular, as the kidney and testis, which consist of tubules of membrane, lined with secreting cells, arranged like an epithelium, &c. These all agree in presenting a large extent of secreting surface within a small, comparatively solid space.

What is a general law in regard to secretion?—Other things being equal, the greater the vascularity of a secreting organ, and the larger the supply of blood traversing its vessels in a given time, the larger the amount of secretion. This however does not determine the quality of the secretion.

What circumstances influence the quality and quantity of the secretions? — The quality of the blood, the quantity of blood, and the nervous influence. We have treated of the skin in detail before; we now only return to the excretion.

Of what does the excretion from the skin consist?—That from the sebaceous glands, and hair follicles, and the perspiration, eliminated by the sudoriparous glands.

Describe these two. — The former consists of cast-off epithelium cells, with nuclei and granules, together with an oily matter and stearine, and in certain parts it is mixed with a peculiar odorous principle. The latter is usually formed so gradually, that the watery portions escape as soon as it reaches the surface, and is called insensible perspiration. The sweat glands are computed by E. Wilson at 7,000,000, and the conjoined length of the tubes at 28 miles. When the sweat is not evaporated as fast as secreted, it forms what is termed sensible perspiration. The perspiration has an acid reaction, and

contains some salts, principally chlorides and animal matter. This secretion is depuratory, and vicarious with that of the kidney.

What is the probable amount of fluid and solid matter lost from the skin and pulmonary surface? — 18 grains per minute: of these, 11 pass by the skin, the balance by the lungs. The solid matter thrown off from the skin is about 100 grains in 24 hours.

Does not the state of the temperature, and the vascular and nervous system have an influence over the amount of fluid thrown off?—Yes.

PANCREAS, AND ITS SECRETION.

Where is the pancreas situated, and what is there peculiar in its secretion? — The pancreas is situated within the curve formed by the duodenum, and opens into the intestine either by a small opening through a duct, common to it and the liver, or by one appropriate to itself. Its secretion, when pure, is colourless, limpid, viscid and gluey, has no characteristic odour; slightly saltish in taste, resembling the serum of the blood. According to Bernard, it has an alkaline, and never either an acid or neutral reaction. It coagulates by heat and the mineral acids, but not by dilute acetic, lactic and hydrochloric. The constituent of the part which is coagulable by heat, though apparently identical with albumen, is not so. At a high temperature, pancreatic juice is decomposed; at a low one, it may be preserved many days. Its principal office is the digestion of fatty matters, and secondarily, to convert starch into sugar.

THE LIVER AND ITS SECRETION.

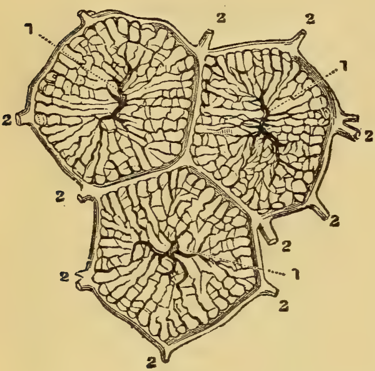
Describe the liver.—It is the largest and most constant gland in the animal economy. It is composed of small granular bodies, the size of a millet-seed, termed lobules, or *acini*. When divided longitudinally, they present a somewhat foliated appearance (Fig. 142), arising from the distribution of the hepatic vein, which, passing into the centre of each division, is termed *intralobular vein*. The exterior of each lobule is compressed by a process of the "capsule of Glisson."

Fig. 142.

The structure of each lobule is an epitome of the whole organ. When the lobules are transversely divided, they present pentagonal or hexagonal shapes, with rounded corners or angles, in which lie branches of the vena portæ, hepatic artery, and duct; and from these are derived the plexuses which compose the lobules. These lobules are connected by areolar tissue and anastomosis of blood-vessels. The

vena portæ, formed by the convergence of the veins which return the blood from the chylopoietic viscera, probably also receives the blood which is conveyed to the liver for its nutrition by the hepatic artery. After dividing and subdividing, it at last forms a plexus of vessels which lie in the interlobular spaces, and are called *interlobular veins,* which, after ramifying in the capsules of the lobules, then enter their substance, and are called *lobular veins,* and the plexus formed by their convergence from the circumference of each lobule towards its centre, is termed lobular venous plexus. (Fig. 143.) In the islets of this plexus the ramifications of the hepatic duct are distributed

Fig. 143.



What is the distribution of the hepatic artery? — It sends branches to every part of the liver, supplying the walls of the portal and hepatic veins, the hepatic duct, and Glisson's capsule. The branches are principally distributed, however, to the lobules, through the interlobular spaces; after ramifying upon the interlobular ducts and capsular surface of the lobules, they penetrate them. The capillaries of the artery either enter the portal plexus or hepatic vein—which of the two is a matter of doubt.

What is the distribution, &c., of the hepatic veins? — The branches occupy the interior of the lobules, and are termed intralobular. By making a section transversely of a lobule, the centre vessel is seen formed by a convergence of smaller veins arising from processes on the surface of the lobule. In the superficial lobules the intralobular veins commence from their surface. The intralobular veins terminate in the larger trunks collecting their venous blood, and are called sublobular veins. The main trunk of the hepatic vein terminates in the ascending vena cava.

Describe the hepatic ducts.— They also form interlobular plexuses like that of the portal vein, though the anastomosis is less marked, and do not send branches interiorly. How they terminate, and what relation they bear to the hepatic cells, is a matter of doubt.

Describe the biliary or hepatic cells. — They are the real secreting agents of the liver, and are of a flattened spheroidal form, from 1–1500 to 1–2000th of an inch in diameter. Each contains a distinct nucleus, and the cavity of each cell is occupied by a yellow amorphous biliary substance with one or two large adipose globules, or a number

of smaller ones. They may be obtained by scraping a piece of fresh liver.

Is the secretion of bile constant, and what becomes of it?—Yes, though it varies in quantity. It is either poured directly into the bowels or regurgitates into the gall-bladder, where it becomes more inspissated, and mixed with the mucus of the coats of the gall-bladder.

What are the physical and chemical properties and compositions of bile?—It is a thick, ropy fluid, greenish yellow colour, and bitter taste, and nauseous smell, mixing with water, also with fat and oil. It contains from 9 to 12 per cent. of solid matter, sp. gr. 1020 to 1030. It contains cholesterine or bile fat, consisting chiefly of carbon and hydrogen, bilic acid, described by some chemists as choleic acid, bilin, picromel, &c.; a compound of soda with what is now considered a fatty acid and biliverdin, a substance analogous to the chlorophyle of plants, besides chloride of sodium and extractive phosphate and sulphate of soda and lime.

What are the uses of the bile?—A portion passes off by the bowels, including the colouring matter, which is no doubt excrementitious. Its soapy portion combines with fatty substances, and renders them soluble, and more readily absorbed by the lacteals. From the experiments of Bernard, we learn that the secretion of bile is not the only use of the liver, but that the sugar found in the blood of the hepatic vein, and in the substance of the liver itself, may be generated at the expense of the proteinaceous compounds by this organ; and so also of liver-fat, the production of which is vicarious with that of sugar.

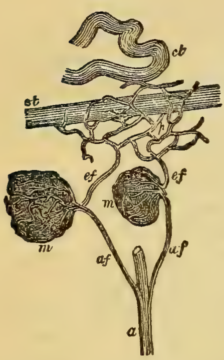
What are the sources of the bile?—The disintegration of fibrinous and nervous tissues, when the food is only sufficient to supply the waste of the system, the liver removing such products as are rich in carbon and hydrogen, &c. The blood from which the bile is secreted some suppose is that from the hepatic artery, others the vena portæ. Those who deny that it is secreted from the hepatic artery, assign its duty as a mere nutrient vessel to the liver. Those who deny that the vena portæ affords the blood, assigns its duty as a mixer of the blood with substances absorbed from the stomach, intestines, &c.

THE KIDNEY, AND SECRETION OF URINE.

Describe the kidney.—This organ is of the utmost importance in the economy, separating, as it does, the refuse nitrogen, phosphorous, sulphur, lime, and magnesia, from the blood, as the liver does the refuse carbon. It is a tubular gland; it is divided into a cuticular and medullary part; in the former the convoluted tubes exist, in the latter the straight. The cuticular portion is the more vascular, and in it small dark points, called corpora malpighiana, are seen, formed by convolutions of minute blood-vessels, into which a twig of the renal artery enters, and from which the blood flows by a small venous twig. This cuticular portion is most probably the true secreting portion, and the medullary

contains the tubes by which the secretion is probably taken off. The malpighian bodies are inclosed in an expansion of the tubuli uriniferi, here, and from the arterial blood the watery part of the urine is soaked out through the walls of the blood-vessels and tubes of the malpighian bodies. (Fig. 144.) In addition to this, the venous twig, after leaving the malpighian bodies, again assumes a capillary arrangement, and at another part interlaces with the tubuli uriniferi; here, and from this venous blood, by means of cells developed in the walls of the tube, solid matters are separated in the urine.

Fig. 144.



What happy provision is effected by the arrangement of the malpighian bodies?—They get rid of the superfluous water of the urine, and the kidney acts consequently as a regulating valve to the system, in regard to the proper amount of water in the body, which would be only partially effected if we solely depended upon the skin and lungs—they being so easily affected by temperature and moisture.

Upon what does the elimination of solid matter depend?—Upon the waste in the system, and the quantity of surplus azotized aliment, which has to be discharged through this channel.

What is the effect of the retention of the components of the urinary secretion in the blood?—Uræmia takes place, and symptoms analogous to narcotic poisoning, formerly supposed to be dependent upon urea in the blood, but now, according to Frerichs, to the presence of carbonate of ammonia, formed from the urea by the presence of a ferment.

What is the quantity of urine voided in twenty-four hours, its specific gravity, &c.?—This varies with the amount of fluid ingested, and the state of the external temperature, being greater in winter than in summer. Prout estimates the quantity at 30 oz. in summer and 40 oz. in winter, where no more drink is taken than the simple wants of nature require. Its specific gravity averages 1020 the whole year round in a healthy person.

What is the amount of solid matter in 1000 parts of urine?—From 20 to 70; the third of the solid matter is formed of alkaline and earthy salts, the remainder of organic compounds.

What is the appearance, odour, and reaction of fresh healthy urine?—Transparent, amber-yellow-coloured, exhales a peculiar odour, with a bitterish saline taste, and has an acid reaction.

What is the most important of the organic constituents of the urine?—Urea. This exists preformed in the blood. It is a transparent crystalline substance, soluble in water, and combines with acids without neutralizing them. Chemically, it is identical with cyanate of ammonia. It is largely excreted by children, and small in proportion

to their bulk by old men. The amount of urea excreted depends upon the degree of muscular exertion, and the amount of azotized matter taken in. Its average amount is about 30 parts in 1000.

What are other ingredients in the urine? — Uric or lithic acid, a crystallizable, nearly insoluble salt in water, inodourous, &c. Formerly, chemists made a distinction between the two, but more recently they describe them as the same. The formation of it in the system is favoured by a highly-azotized diet and inactive life. It is often deposited in the joints in chalky concretions; urates are generally red. It also contains saline matter, as the muriates, sulphates, and phosphates, &c. The quantity of the salts in the urine varies; men have a larger proportion than women. In addition, we detect extractive matters in the urine, and accidentally-mixed substances, depending upon food, drink, and medicine.

VASCULAR OR DUCTLESS GLANDS.

What are the glands generally termed vascular, or ductless?—The spleen, thymus, thyroid, and supra renal bodies.

What is the composition of the spleen? — It consists of a fibrous coat, composed of white and yellow fibrous tissue; of a trabicular tissue, consisting of fibrous bands and threads, which form a net-work internally, in which interstices we have splenic corpuscles and parenchyma. The splenic arteries do not anastomose, but ramify, like the branches of a tree, with the splenic corpuscles attached to them like fruit; beyond these they divide into a tuft of arteries, more minute, and these again into true capillaries. The veins ramify like the arteries, and have no valves. The lymphatics are few and inconsiderable, and the nerves are apparently large, but in fact the *nerve fibres* are very small.

What is the use of the spleen, &c.? — The spleen acts as a diverticulum to the portal circulation; the thyroid to the brain; the thymus to the lungs in the fœtus, and the supra renal corpuscles to the kidneys, &c.

FUNCTIONS OF THE NERVOUS SYSTEM.

What is meant by animal functions, and how are they divided? — Those which render the animal conscious of external impressions, and which are dependent upon the nervous system, by which the animal is capable of executing spontaneous movement. They are divided into sensation, muscular motion, and mental manifestation.

What does the nervous system of man consist of?—An aggregation of separate ganglionic centres, more or less connected together by commissural fibres.

What is the simplest form of a nervous system? — A single ganglionic centre, with afferent and motor nerves, whose offices are essentially internuncial, connecting the central organs with other parts by

means of the nerve trunks. These nerve trunks are distributed to the sensory surfaces or organs, and to the muscles or motor organs. The first are termed sensory or afferent, conveying impressions from the periphery to the centre; the latter from the centre to the periphery, and are called efferent or motory.

Upon what does the functional activity of the nervous system depend? — Upon a due supply of oxygenated arterial blood, and also a combination of its oxygen with the elements of nervous structure.

What are the fundamental parts of the nervous system of man?— The cranio-spinal axis, consisting of the spinal cord, medulla oblongata, sensory ganglia, and sympathetic. The entire cranio-spinal axis is divided into cranial and spinal portions, where the cord passes through the foramen magnum occipitis; this, however, is an artificial division.

What do you understand by the spinal cord? — That part which extends from the margin of the foramen magnum occipitis to the first or second lumbar vertebra, and is extended at the *filum terminale* to the extremity of the spinal canal.

How is it divided? — By the anterior and posterior median fissure dividing into two lateral valves. We have also two furrows on each side.

How is the *gray matter* of the spinal cord exposed? — By making transverse sections of the cord in various parts.

Is the spinal cord uniform in its dimensions? — No. It presents enlargements by an increase in gray and white substance at the origins of the large nerves forming the brachial and crural plexus.

Under what aspects is it to be considered? — As an independent centre of nervous power, on which excitor impressions operate to produce reflex movements; and as the channel of communication between the roots of the spinal nerves and the encephalic centres, whereby sensory impressions are transmitted upwards to the sensorium, and motor influences generated in the brain are transmitted downwards to the afferent nerves.

How does each spinal nerve connect with the cord?—By two roots: the anterior, near the anterior furrow, and the posterior, near the posterior furrow.

What are the functions of these two roots? — The posterior, upon which a ganglion is situated, and which is the sensory and excitory root, is the *afferent* root; part of its fibres running to the brain convey impressions to it, and part terminate in the gray matter of the cord, conveying impressions to it. The anterior, or afferent, or motor root:—part of its fibres come from the brain, conveying voluntary motion, and part have their origin in the gray matter of the cord, and convey excited motion from it. Those fibres of both roots which are unconnected with the brain, are the system to which reflex actions are due, and which constitute a distinct nervous circle with the gray matter of the cord. Part of the afferent or excitor fibres, after tra-

versing the gray substance, pass out of the same side as the afferent or motor nerves, whilst another portion crosses to the opposite side and forms part of its efferent trunks. Each spinal nerve contains four sets of fibres.

What are contained in the posterior or afferent root? — A sensory bundle, and a set of excitor fibres, terminating in the true spinal cord or ganglion.

What are contained in the anterior or efferent root?—A bundle of motor fibres, conveying impressions from the brain, and a motor set, arising from the true spinal marrow, and conveying motor influences reflected from it to the muscles.

What is the influence of the *gray matter* in the spinal cord? — It has an inherent motory power, which is communicated to its nerves independently of the brain, which motions are automatic, proceeding directly from the spinal cord, in consequence of an excitement effected through the fibres of the spinal nerves, which terminate in the gray matter; these motions are *reflex.*

In reflex action is sensation necessary?—No; all that is required is an afferent fibre, capable of receiving the impression and conveying it to a ganglionic centre, into which the afferent fibre passes; and an afferent fibre to convey the motor impulse from this centre to the muscle to be influenced.

Is there much evidence of reflex action in the human limbs during health?—No.

Are the functions of the columns of the cord determined? — No; various opinions exist; for which we must refer to Carpenter, Todd & Bowman, Valentin, and others.

FUNCTIONS OF THE MEDULLA OBLONGATA.

What is the medulla oblongata? — The cranial prolongation of the spinal cord.

What are its divisions? — Into anterior pyramids, or corpora pyramidalia, olivary bodies, or corpara olivaria, restiform bodies, or corpora restiformia; otherwise called processus a cerebello ad medullam oblongatum, and the posterior pyramids, or corpora pyramidalia posteriora. The vesicular, or gray matter, is principally aggregated in three pairs of ganglionic centres, of which the anterior forms the nucleus of the olivary body, the lateral of the restiform, and the posterior of the posterior pyramidal. (Figs. 145, 146.)

Of what do the anterior pyramids, olivary bodies, &c., consist, and what is the direction of their fibres, &c.? — The anterior pyramids consist of a fibrous structure, and establish a communication between the "motor tract" (Fig. 147) of the crura cerebri, and the anterior and antero-lateral columns of the spinal cord most of the fibres decussate, and dipping down, connect with the middle or lateral columns. Those which do not decussate, dip downwards on the same side to the

corresponding anterior column. The olivary bodies are composed of fibrous strands, enclosing a gray nucleus on either side. The upward continuation of the former divides while passing through the pons

Fig. 145.

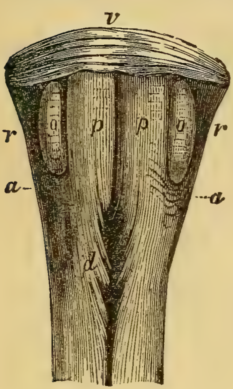
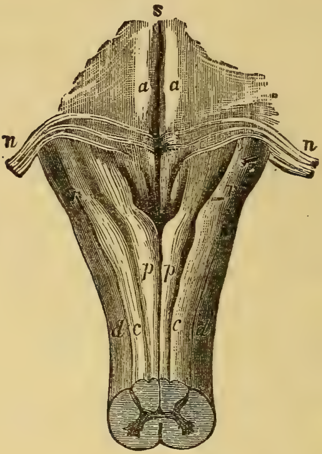
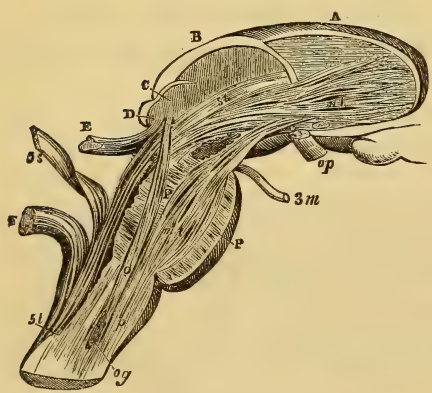


Fig. 146.



varolii, into two bands, one of which proceeds up and forwards, as part of the "motor tract" of the crus cerebri, whilst the other proceeds upwards and backwards, to reach the corpora quadrigemina. The olivary columns are continuous inferiorly with the anterior columns of the spinal cord, to which the 1st and 2d cervical nerves are attached. In its centre is the *corpus dentatum*—a gray body, from which, anteriorly, a portion of the roots of the hypoglossal or motor nerve of the tongue issues; posteriorly, a portion of the glassopharyngeal, or one of the sensory nerves of that organ, terminates. The restiform bodies are also composed of fibrous strands, inclosing a gray nucleus The fibrous strands pass up to the

Fig. 147.



crura cerebelli, and below are continuous, chiefly with the posterior columns of the spinal cord, and a slight connection with the middle columns. A band of "arciform fibres" (Solly), connect the cerebellar columns with the cord. The gray nucleus is the ganglionic centre of the pneumogastric, and part of the roots of the glossopharyngeal. The posterior pyramids are scarcely distinguishable from the restiform bodies; they, however, establish a communication between the sensory tract of the crura cerebri and the posterior columns of the lateral columns of the spinal cord. The gray nuclei placed beneath the "fourth ventricle, is considered as the auditory ganglia.

What are the prominent properties of the medulla oblongata?—It is chiefly marked by its influence in respiration and deglutition, though it possesses the general characteristics of the spinal cord. The reflex action is prominently conspicuous in it. It may be considered both as a medium of communication between those parts within the cranium and the spinal cord, and also as an independent nervous centre of reflex action.

What is the structure of the pons varolii?—It is composed principally of transverse fibres, connecting the two hemispheres of the cerebellum, and also numerous longitudinal interlacing fibres, which connect the medulla oblongata and cerebellum, and transverse fibres, which connect it with the cerebellum. It forms the necessary connections, to conclude; 1, by which the cerebrum is connected with the tracts of the medulla oblongata, except the restiform and lateral; 2, by which the cerebellum is connected with these two tracts; 3, by which the two hemispheres are united; and, if we include the *fonticulus* as part of the pons, the fibres by which the anterior pyramidal and restiform tracts of the medulla oblongata are connected with each other.

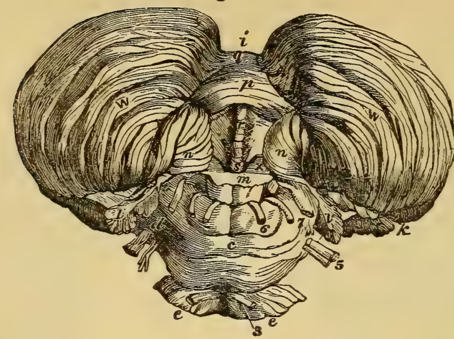
What function is attributed to it?—That of conducting impressions in continuation from the medulla oblongata to the cerebrum and cerebellum, and of a nervous centre; as probably it may be regarded as the lowest portion of the encephalon, where the mind may have sensations of impressions, or exercise the will when the *rest* of the brain is removed.

STRUCTURE AND PHYSIOLOGY OF THE CEREBELLUM.

Of what do each of the halves of the cerebellum consist?—Of the fibres combined in the crus cerebelli: 1st. Of those from the restiform tracts of the medulla oblongata. 2d. The commissural fibres, together with those going outwards from the lateral tracts of the medulla oblongata. 3d. Interchanging fibres, between the cerebellum and cerebrum. In the prolongation of the crus cerebelli, where these fasciculi are combined, we have a mass of gray matter, *corpus dentatum*, which sends off lamellæ. (Fig. 148.)

What appears to be the functions of the cerebellum?—It was formerly supposed very generally that it was the peculiar organ of

Fig. 148.



sexual desire; experiments, however, now appear to indicate this a fallacy to a great degree. The more general opinion is that it presides over the harmonization and regulation of muscular movements, especially the voluntary.

STRUCTURE AND PHYSIOLOGY OF THE CEREBRUM.

What is the structure of the cerebrum?—It is peculiar in having its vesicular substance exteriorly, by which a larger surface is exposed, affording on one side a surface for the free supply of blood, and to give it proper functional activity, and on the other to give it a more ready communication with the fibres by which its influence is to be propagated. This, in higher cerebral structure, is still further shown by the plication of the vesicular matter in convolutions. The medullary matter presents three different sets of fibres: 1st. The radiating fibres connecting the vesicular matter of the cortical substance of the hemispheres with the thalami optici; 2d. The radiating fibres connecting the vesicular matter of the cortical substance of the hemispheres with the corpora striata; 3d. The commissural fibres, between the two hemispheres and different parts of the vesicular substance of the same side.

What are the functions of the cerebrum?—It has been proved that it is not essential to life, but presides over intellectual development; and that to the convolutions we are most indebted for a greater or less amount of intellectual vigor.

What is the weight of the entire encephalon?—From 40 to 60 oz. in the adult male, and in the female, from 36 to 50 oz. The maximum of healthy brain is about 84 oz., and the minimum 31 oz. In idiocy it has been as low as 21 oz.

[Of the supply of blood and the peculiar arterial arrangement for the brain, we have spoken before.]

Is not a certain amount of regulated pressure upon the walls of the blood-vessels of the brain necessary for the brain to perform its offices correctly? — Yes; as the supply of blood is more or less, according to functional activity, &c. We have, for the purpose of keeping up a constant, equal pressure, a fluid secreted underneath the arachnoid membrane, averaging 2 oz., wherever the pia mater exists, the withdrawal of which in living animals produces great disturbance in the cerebral functions. It, however, is capable of being speedily regenerated.

What is the comparative amount of the cerebral hemispheres? — It is four times that of all the rest of the cranio-spinal mass, and eight times that of the cerebellum.

What are included under the designation of encephalic ganglia?— The corpora quadrigemina, optic thalami, and corpora striata.

What are the functions of each of these? — That of the tubercula quadrigemina, as the principal nervous centres for the sense of sight. The optic thalami probably participate slightly in the visual function of the preceding; but they appear chiefly connected with *common sensation.* The corpora striata appear to preside over the *motor function.*

What other ganglia do we notice? — At the base of the brain, and in direct connection with the nerves of sensation, with functions peculiar to themselves, we have anteriorly the olfactive ganglia, with the bulbous expansions of the olfactory nerve. The auditory ganglia being on each side of the fourth ventricle, not distinctly marked. The ganglia of the *sense of touch,* probably existing on the posterior roots of the spinal nerves, and of the fifth pair. The gustatory ganglion, considered to be the nucleus of the glosso-pharyngeal nerve, and to which a portion of the sensory root of the fifth pair may be traced, is imbedded in the medulla oblongata.

SENSATION.

What do you understand by this? — The consciousness of an impression. They are of two kinds: that produced by agents exterior to the body, and that from the interior of the body, arising from alteration of function in the part for the time.

What are the organs of sensation? — Those parts of the nervous system and their dependencies which, when stimulated, occasion in the mind a perception of the impression.

What are meant by *subjective* and *objective* sensation? — By the former, we mean those sensations excited by stimulus originating in the body itself, especially if it act rather on the intermediate than on the peripheral part of the sensitive apparatus. By the latter, those where the stimulus is derived from without.

How are sensations divided? — Into common or general, and special. The former comprehends a variety of internal sensations minis-

tering for the most part to the organic functions and the conservation of the body. By this we are made sensible of pleasure and pain, &c. By the latter, those peculiar impressions made upon certain nerves which are *alone* formed to receive them. No nerve of special sensation is affected by anything excepting its own proper stimulus, as light for the eye, sound for the ear, &c. They have in themselves no *common* sensibility.

What are the special senses? — Touch, taste, smell, hearing, and seeing. Some add to these a muscular sense, by which muscular contraction can be produced and regulated according to the will, &c.

How are the organs of the special senses divided? — Into physical and vital. The former, that which receives and regulates the impression; the latter, that which transmits the impression to the brain.

What circumstances modify the general sensibility? — An active, healthy, capillary circulation is necessary to its sensibility. When we have an increased or diseased circulation, we find sensibility morbidly developed.

Are not the spinal senses liable to become obtunded by over-excitement or excessive repetition?—Yes; excepting where the attention is particularly directed to them, when their acuteness of sensibility is increased.

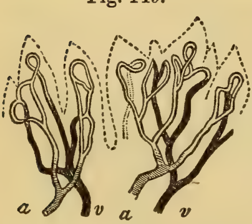
TOUCH.

Is not this the most diffused, simplest, and most rudimentary of the special senses? — Yes. It is also the earliest called into operation, and least complicated in its impressions and mechanism.

Whence are the nerves of touch derived? — From the same part of the cerebro-spinal system as those of common sensation; as the posterior roots of the spinal nerves, and some fibres of the eighth and fifth encephalic nerves.

What are the peculiarities of the peripheral extremities of the nerves of touch? — They are distributed to the tactile papillæ of the skin, in which elevations we have loops of blood-vessels and sensory nerves upon the exterior of the cutis vera; the papillæ being covered by the epidermis, which protects them. (Fig. 149.)

Fig. 149.



In what parts is the sense of touch most prominently developed? — In the tip of the tongue, lips, palmar surface of the last joint of the fingers, &c.; in fine, wherever the sensory nerves are freely supplied.

What ideas are conveyed to our minds by this sense? — Resistance, roughness or smoothness; and when the sensory surface is moved over the object, or surface felt, we have an idea of extent or space.

What other peculiarities attend this sense?—It can be highly educated (as in case of the blind, who can

be taught to read by it). The impression made, also, may continue some time after the stimulus is removed.

What do you remark in regard to the subjective sensations pertaining to these nerves? — They are most familiar, as in case of the tingling of a limb "asleep," which commonly depends on pressure on its trunk; many depend on morbid changes in the centre, so also sensations of formication, &c.

TASTE.

What do you remark in regard to this sense? — That it is subservient to the nutritive function, by guiding, as in the discrimination of food, &c. It is situated in the mucous coat of the tongue and fauces.

What are the anatomical and physiological characteristics of the tongue? — It is covered by a tough corion or cutis, which contains the ramifications of the bloodvessels and nerves which supply the *papillary structure;* which structure is not concealed under the epithelium, but stands out freely from the surface. The epithelium of the tongue is of the scaly variety, and in this resembles the cuticle; generally it is thinner than in the skin, and each large papillæ has a separate investment from summit to root. The papillæ are divisible into three varieties: the circumvallate or calciform, eight or ten in number, situated as the letter V at the base of the organ; the fungiform, scattered over the surface, particularly about the sides and apex; the conical, or filiform, the most numerous, but particularly on the central part. When these papillæ are excited by any savoury substance they become erect.

Are authors agreed upon the *precise* seat of taste? — No; but it is generally conceded that it more prominently exists in the base, sides, and apex.

What are the nerves of taste? — It seems divided between the glasso-pharyngeal and the fifth; the former is also the afferent nerve to the reflex act of swallowing.

What is the character of the hypoglossal, or ninth pair? — It is the nerve of motion to the tongue.

What are the conditions necessary for the performance of this sense? — That the substance to be tasted is soluble, and brought in contact with the papillæ and their nerves. It is much influenced by the extent of surface acted upon, and is heightened by the motion and moderate pressure of the substance on the gustatory membrane. The act of swallowing seems necessary to the perfect appreciation of flavour; this is partly explained by considering how much the sense of smell increases that of taste. The impression of cold air deadens this sense.

Does not chemical or mechanical excitation of the nerves of taste produce this sense? — Yes.

Is not this sense, like that of touch, improved by its education? — Yes.

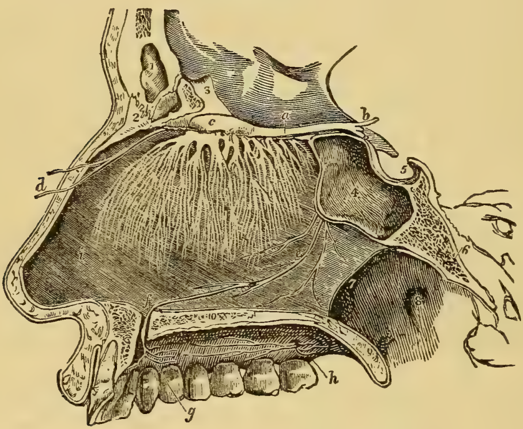
Do not the impressions of taste remain longer than those of the other senses? — Yes; on account of the fluids which excite it remaining for some time longer in contact with the nerves, after saturating the papillæ.

Do we know much of the subjective phenomena? — No.

SMELL.

Where is this sense situated? — In that portion of the nose immediately below the cribriform plate of the æthmoid bone, through which the olfactory nerves reach the membrane, and extends about one-third or one-fourth downwards in the septum, and over the superior and part of the middle spongy bones of the æthmoid bone. (Fig 150.)

Fig. 150.



What is the object of this sense?—To acquaint us with the odourous qualities of particles *suspended* or dissolved in the atmosphere. It is necessary *always* that the particles should be dissolved or suspended in the atmosphere to make an impression.

What is, however, its principal use?—Though it protects the lungs from the inhalation of deleterious gases, it chiefly is concerned in seconding the impressions of taste, in conveying intelligence of the properties of food, &c.

What nerves not concerned in the special sense of smell supply other than the olfactory portion of the mucous membrane of the nostrils? — Branches of the *fifth pair*, a nerve of general sensibility, derived from the ophthalmic and superior maxillary divisions. This nerve is concerned in the reflex act of sneezing.

What conditions are necessary in the olfactory mucous membrane

besides a healthy condition of the nerves?—A healthy condition of the mucous membrane.

What are some of the causes of the subjective phenomena sometimes occurring in this sense?—Injury of the anterior lobes of the brain and disease of the olfactory bulb.

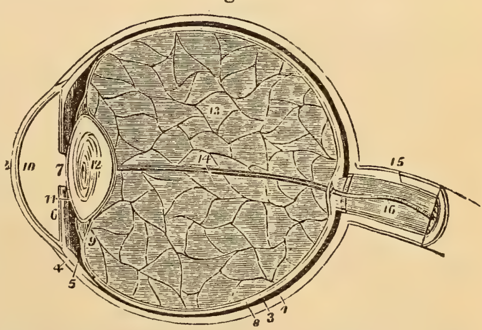
VISION, OR SENSE OF LIGHT.

What is the object of this sense?—To acquaint us with the existence of light, and with colours, and form of surrounding objects, &c.

What are the most important parts of the eye concerned directly in vision?—The expansion of the *optic nerve*, (the *retina*), in front of which we have the *transparent refracting media*, the vitreous humor, crystalline lens, and aqueous humor, to transmit the light, and bring it to a focus upon the retina.

What are the various parts of the eye?—To retain the figure of the retina, and to protect it, we have the *sclerotic* coat, a white fibrous tissue, opaque, excepting in front, where it is modified in structure, and becomes transparent, to allow the light to enter, and is called the *cornea;* between the sclerotic coat and the retina we have interposed a layer of dark pigment in a delicate membrane, termed the *choroid*, which absorbs the rays of light after making the impression on the retina. In front of the *retina* are the *transparent media:* 1st. The *vitreous* humor contained within the cup which the retina forms, giving an internal support to it as the sclerotic does an external; this humor occupies four-fifths of the whole globe. Imbedded in its anterior part is a double convex lens, the *crystalline* coming nearly up to the cornea, leaving, however, a small cavity, which contains watery fluid, the *aqueous* humor, between itself and that transparent part of the external case. Across this cavity, and dividing it into an *anterior* and *posterior* chamber, hangs a vertical, curtain-like process, called the *iris*, perforated in the centre by an aperture, the *pupil*, for the admission of light to the anterior chamber, and contractile under the influence of light on the retina, regulating the amount of light entering the organ. The fluidity of the aqueous humor is a provision to allow the expansion and contraction of the pupil, and the movements of the lens to or from the cornea. (Fig. 151.)

Fig. 151.



What relation does the optic nerve bear to the true retina?—After this nerve enters the eye, it divides and spreads into numerous inosculating fibrillæ, forming a plexus, which plexus is brought into relation with numerous vessels and a layer of ganglionic cells, which layer of cells forms the internal layer of the *true retina.*

What is the probable cause of the contraction and dilatation of the pupil?—A sphincter muscle, deriving its energy from the third pair of nerves, under the stimulus of light. The dilatation is caused probably by the elasticity of the tissue of the iris, after the contractility has ceased.

What is the office of the transparent media?—To refract and modify the rays of light, and thereby overcome the *spherical* and *chromatic* aberration.

What are the nerves particularly devoted to this sense of vision?—The optic nerves, or second pair.

What is the origin, course, and distribution of the optic nerves?—They arise from the tubercula quadrigemina, which has been termed the optic ganglia, and run forwards along the inferior surface of each crus cerebri; and, after passing in a concave inward course along the base of the brain, unite in front of the tuber cinereum and mammillary bodies; and, form a very intimate function, called the *chiasma*, or commissure of the optic nerves, whence they diverge, and part of the fibres of each nerve pass to the opposite eye, part are commissural, and the remainder pass to the eye of the same side and enter the orbits through the optic foramina.

How many muscles has the eye, what are their names, and by what nerves are they supplied?—Each eye has six muscles: the recti, or four straight, supplied by the third pair of nerves, excepting the external straight, which is supplied by the sixth pair; and two oblique. The superior oblique, which is supplied by the fourth pair, and the inferior oblique by a branch of the third, and from the sympathetic.

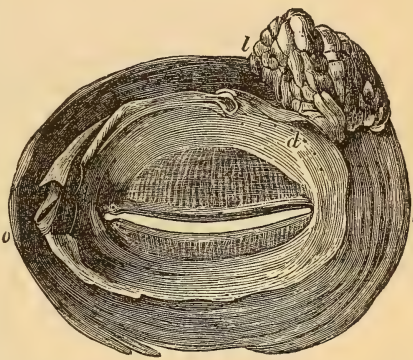
What is the action of these muscles?—When all the *recti*, or straight muscles, act together, they fix the ball; when either one or the other acts alone, it draws the ball towards their respective sides. The oblique muscles antagonise the *recti*, and also when acting together, they draw the globe inwards and converge the axis of the eye; the superior oblique, acting alone, turns the eye inwards and downwards, and the inferior oblique upwards and inwards.

What is the office of the eyelids?—To shield the eye from too strong a light, and to protect its anterior surface from hurtful substances. The upper lid being much larger and more movable than the lower, has a thin sheet of cartilage fitted to it to allow of easy motion over the globe of the eye, called *tarsal cartilage*, to which the palpebræ muscle is attached to elevate the lid. The lower lid has also a narrow slip of cartilage, which meets the upper at each side. Within the eyelids we have the orbicularis muscle, which is supplied by the portio dura, and perhaps some fibres of the fifth nerve, which act

generally to prevent the stimulus of air or foreign particles on the fifth nerve in the conjunctiva, and also a too strong light upon the retina. The hairs along the free margin of the lids, called lashes, intercept the entry of foreign particles against the eye, and assist in defending the organ from excess of light.

What do we understand by the conjunctiva, meibomian glands, &c. — The conjunctiva is a mucous lining continuous with the skin, and lines the tarsal cartilages, and is reflected over the front of the globe. Between the cartilages and the conjunctiva, and partially imbedded in the former, are the meibomian glands, which secretes a delicate fluid to prevent adhesion of the lids. (Fig. 152.) The front of the eye is irrigated by lachrymal fluid, secreted by a gland of that name, which is placed within the orbit, under cover of the external angular process of the frontal bone, which opens by several ducts upon the conjunctiva, which, after lubricating with the fluid, passes off into the nostril; first, by the puncta lachrymalia which lead to two ducts, *canaliculi*, into the lachrymal sac, which is continuous with the nasal duct into the inferior meatus of the nose, where it opens under cover of the lower spongy bone.

Fig. 152.



In studying the physiology of vision, with what should the student be acquainted? — The general laws of light and optics; for which, we must refer him to works upon those subjects.

After examining the laws above referred to, what conclusions do we arrive at? — That when a luminous body is placed 8 or 10 inches in front of the eye, some rays fall on the sclerotica, and are reflected; others fall on the cornea—some being reflected, and others passing through it are slightly converged by it, and enter the aqueous humour, which probably does not alter their course; passing on, some meet the iris, are absorbed or reflected by it, while others advance through the pupil. By these means rays of light are conveyed so as to fall on the lens; which lens, by its convexity and greater density towards its centre, increases the convergence of the rays. The rays of light then passing into the rarer medium of the *vitreous humour*, are further conveyed by the refraction of each ray from the perpendicular to the point of incidence, and the several pencils they form are brought to as many foci in the retina. Further, the rays from the opposite

points of luminous objects, by reason of the change of direction which they undergo through their successive operations, cross one another, (the point where they cross being termed the *visual angle*), and thus the image on the retina appears inverted. When the retina corresponds, or nearly so, to the points of convergence of the several pencils of light, distinct vision of the object is obtained.

What are some of the views entertained in regard to the capacity of adaptation of the eye, under the influence of the will, to distinct vision at every distance beyond that of a few inches? — Having the power of producing some change in the eye, by which its focal length is modified to suit the varying angle at which rays fall upon it, some explain it by asserting that the cornea becomes more convex for near objects, and others that the lens being muscular, possesses within itself the power of changing its curvature; others again ascribe it to the iris, &c. The point is still in doubt.

What are the forms of imperfect vision termed *myopia*, or short-sightedness; and *presbyopia*, or far-sightedness? — The former of these is attributed to too great refracting power of the media, so that the image is formed anterior to the retina, which can be remedied by a double concave lens. The latter is connected with too flat a cornea, a deficient aqueous humour, or a flattening of the lens, and is accounted for by a diminution in the refracting power, so that the focus is behind the retina. It may be corrected by convex glasses.

How do we account for the phenomena, that although an *inverted* image is seen on the retina, yet, to the mind, the object appears erect? —This is still a doubted point. The most prevalent opinion is, that it is the result of intuitive perception.

How do we account for the phenomena of *single vision* with *two eyes?* — That the two images of the object should be formed on parts of the two retinæ, which are accustomed to act together; and habit has much to do with this. In addition to this, double images are conveyed to the sensorium; but through want of force and distinctness, and want of attention, we do not take cognizance of them. It also appears that this is dependent upon the convergence of the optic axes on the object to which our gaze is directed.

Are not the senses of touch and vision associated in many of our impressions?—By these conjointly, we arrive at a knowledge of the properties of bodies, as smoothness, roughness, form, and, to a certain extent, of distance.

Do not impressions made upon the retina continue for some time after the stimulus is removed?—Yes.

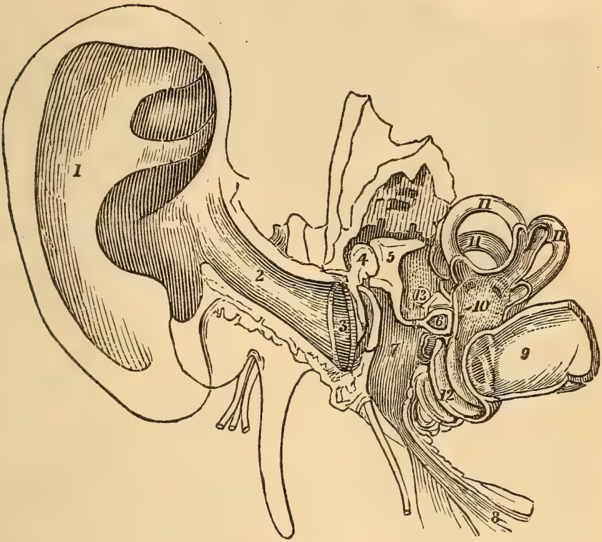
Upon what is a want of appreciation of colours dependent?—Upon some defect in the brain, and not in the eye itself.

HEARING.

What do you understand by hearing? — That impression made by a body, producing the sensation upon the mind, not only by the so-

norous body, but by the condition of the auditory nerve. Hence the changes in sound, as regards its nature, intensity, &c., must be based upon the changes it produces on the auditory nerve. (Fig. 153.)

Fig. 153.



1. Pavilion. 2. Meatus externus. 3. Membrana tympani. 4, 5, 6. Chain of bones 7. Cavity of tympanum. 8. Eustachian tube. 9. Meatus internus. 10. Vestibule. 11. Semicircular canals. 12. Cochlea. 13. Stapedius muscle.

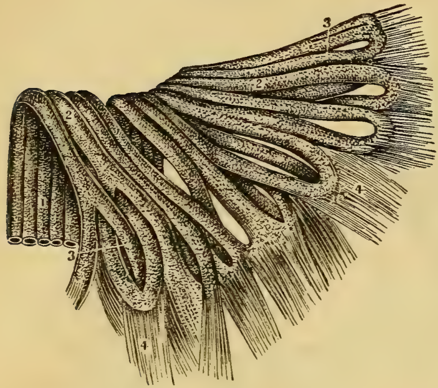
What are the essential parts of the organ of hearing? — A nerve endowed with the peculiar property of receiving sonorous impressions, and of transmitting them to the sensorium.

How is this nerve distributed? — Over the delicate membrane of the *vestibule,* which membrane incloses a fluid, which is the medium of transmitting the sonorous vibrations from the external ear to this nerve.

Have we any as yet definite knowledge how the ultimate divisions of the auditory nerve are distributed upon the lining membrane of the labyrinth?—No; Marquis Costi, in his observations upon the cochlear nerve, (Fig. 154), gives us the following as the most probable. As this nerve passes out of the *modiolus* into a series of anastomosing canals, in the *lamina spiralis,* it there comes into relation with a band of vesicular substance which lies near the edge of the lamina in its whole length. The component vesicles are elongated, having a

central and peripheral extremity; by the former connected with the fibres of the cochlear nerve, and by the latter, similarly connected with the fibres which issue forth from the *osseous lamina*, to be distributed upon its membranous continuation, which fibres form fasciculi, traverse the membranous lamina, and anastomosing, form the appearance of loops.

Fig. 154.



What constitutes the apparatus for conveying sound to the auditory nerve? — The external ear, by which sound is collected, consisting of the *auricle* and *meatus externus*, or auditory canal. The membrane of the tympanum, behind which is the cavity of the tympanum, containing the *ossicles* of the ear, or the *chain of bones, malleus, incus* and *stapes*, extending from this membrane to a membrane *over the foramen ovale*. This cavity communicates also with the throat by the *Eustachian tube*, which admits air to the tympanum. Still further behind this is the labyrinth, consisting of the cochlea and vestibule.

How many ways may sound be propagated? — Three: By *reciprocation*, where a body capable of yielding a musical tone of definite pitch, and another body of the same pitch is made to sound near it, though untouched. By *resonance*, where a sounding body, as a *tuning fork* when placed in connection with any other by which reciprocal vibrations may be produced in one or more parts, although the tone of the whole may be different, or not at all. By *conduction*, as when the ear is placed at the end of a board, and the other end is lightly struck, the sound is *conducted* along the board. All media can conduct sound: solids better than fluids or gases. Sounds will not pass through a vacuum. They are lessened in intensity by passing from an æriform to a dense medium.

What are the offices performed by the auditory apparatus, before mentioned? — The external ear collects the sound, the meatus auditorius conducts it to the membrane of the tympanum, which receives the sonorous undulations, and by *reciprocal* vibration the chain of bones is influenced; by the chain of bones it is communicated to the internal ear; the tympanum isolates the chain of bones and allows free vibration; the air communicated to it by the Eustachian tube,

maintaining an equilibrium between the external air and that in the tympanum, preventing too great tension of the membrane of the tympanum. In regard to the uses of the different parts of the labyrinth we know little; although from the constant presence of the vestibule, we infer it to be of the utmost importance in audition.

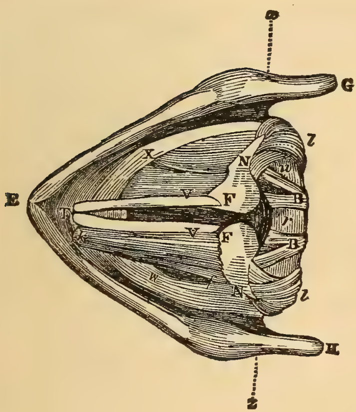
VOICE AND SPEECH.

Where is the voice produced? — In the larynx.

Are not *vocal sounds* and *speech* two distinct subjects?—Yes; the modification of the voice by which speech is produced for the most part is by the mouth. (Figs. 155, 156.) (For the anatomy of the larynx, see *Anatomy*.)

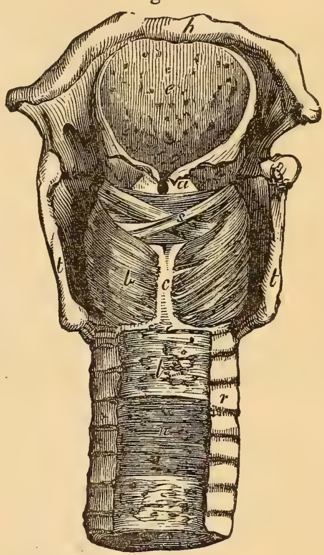
Upon what depends the variety of tones in the voice? — The ten-

Fig. 155



Bird's-eye view of *Larynx* from above: G E H, the thyroid cartilage, embracing the ring of the cricoid *r u* X *w*, and turning upon the axis *x z*, which passes through the lower horns. N F, N F, the arytenoid cartilages, connected by the arytenoideus transversus. T V, T V, the vocal ligaments. N X, the right crico-arytenoideus lateralis (the left being removed). V *k f*, the left thyro-arytenoideus (the right being removed). N *l*, N *l*, the crico-arytenoidei postici; B B, the crico-arytenoid ligaments.

Fig. 156.



Posterior view of larynx, and part of trachea, dissected to show the muscles. *a*, right arytenoid cartilage. *t t*, posterior margins of thyroid cartilage. *c*, back of cricoid cartilage. *h*, os hyoides. *e*, epiglottis. *b*, left posterior crico-arytenoid muscle. *s*, arytenoid muscle. *l*, fibrous membrane at back of trachea, with the glands lying in it *n*, muscular fibres of the trachea. *r*, cartilaginous rings of trachea.

sion of the vocal ligaments, and also the bringing of them into almost parallel lines, by the approximation of the arytenoid cartilages, and the reverse.

What are the muscles which govern the pitch of the notes, and the aperture of the glottis? — Those which govern the pitch, are:

Antagonists.	Crico-Thyroidei, Sterno-Thyroidei,	Depress the front of thyroid cartilage on the cricoid and stretch the vocal ligaments, assisted by the arytenoideus and crico-arytenoidei postici.
	Thyro-Arytenoidei, Thyro-Hyoidei,	Elevate the front of the thyroid cartilage and draw it towards the arytenoids, relaxing the vocal ligament.

Those that govern the aperture of the glottis, are:

Antagonists.	Crico-Arytenoidei postici,......	Often the glottis.
	Crico-Arytenoidei laterales, Arytenoideus transversus,	Press together the inner edges of the arytenoid cartilages, and close the glottis.

The muscles which stretch or relax the vocal ligaments are entirely concerned in the modulation of voice; those which govern the aperture of the glottis are engaged in respiration, and guard the entrance to the lungs.

To what class of instruments does the vocal apparatus bear the closest analogy? — The *reed* instrument, from the fact that laminæ or *reeds*, so to speak of mucous membrane, are stretched over the vocal ligaments, and there, more or less, these various notes are produced.

Upon what does the *intensity* and *quality* of the voice depend ?—The intensity or *volume* partially from the forcible expansion of air from the lungs, and the capacity of the thorax, and also from the facility with which the vocal cords and other parts of the larynx vibrate. The quality depends upon the smoothness or roughness of the cartilages of the larynx, and the facility with which different parts of the larynx vibrate. The inferior ligaments of the larynx are the most important in producing voice.

PART III.

SURGERY.

INFLAMMATION.

DESCRIBE inflammation.—It is an unnatural condition of a part of the body, attended with pain, swelling, redness, and increase of heat.

Does the temperature of an inflamed part ever exceed that of the blood at the source of circulation?—It does not.

How has inflammation been divided?—Into healthy inflammation, or that which has for its object the reparation of injuries; and unhealthy inflammation, or that which tends to the destruction or injury of a part. It has also been divided into acute and chronic.

What constitutional disturbance is frequently excited in extensive or violent inflammation?—Fever, ushered in with chill, nausea, and headache; the pulse quick and at first small, but afterwards full and hard; the tongue dry and parched; the urine scanty and highly coloured; and bowels torpid.

What are the appearances of blood drawn during inflammation?—It coagulates slowly; the coagulum being firm, and having generally the buffy coat, and sometimes exhibiting a cupped appearance.

Is the presence of the buffy coat a sure indication of the existence of inflammation?—Not always; for sometimes it exists where inflammation is not present (as in pregnancy) and *vice versa*.

What are the terminations of inflammation?—Resolution, adhesion, effusion, suppuration, hemorrhage, ulceration, granulation, cicatrization, and mortification.

How are the causes of inflammation divided?—Into chemical and mechanical.

Enumerate some of the chemical causes?—Excessive heat or cold, acids, alkalies, vesicatories, rubefacients, animal poisons, the virus of specific and contagious diseases, noxious gases, and sometimes atmospheric air.

Enumerate some of the mechanical causes? — Wounds of various kinds, contusions, fractures, luxations, long-continued pressure, and the presence of foreign bodies.

What tissues are subject to inflammation? — Almost all, except (in the opinion of some) the cartilages, in which this exemption is attributed to want of vascularity.

What are the general remedies to be made use of in inflammations? — General bloodletting, purging, antimonials, mercurials cooling drinks, abstinence from food, rest, the recumbent position, with the elevation of the part affected. Opiates are in certain cases useful.

What are the local remedies? — Cupping, leeching, scarification, moist fomentations, poultices, lotions, blisters; and alterative applications, as mercurial ointments, nitrate of silver, &c.

How are we to be guided as to the repetition or discontinuance of bloodletting?—If the pulse rises during or immediately after bloodletting, or if the pain continues severe, with a hard and frequent pulse, we are justified in repeating bloodletting at proper intervals; but if great prostration be induced, or the coagulum of the blood be deficient in quantity, we must lay aside bleeding.

What other cautions are to be observed in the treatment of inflammations? — Blisters and other counter-irritants must only be used in chronic inflammations; in acute inflammations it is best to take away sufficient blood at once to produce a decided impression upon the pulse; in chronic cases, and, according to some writers, in all inflammations of vital parts, small and frequent bleedings are to be employed.

What is resolution? — The subsidence of inflammation before it has produced any morbid change of structure.

What is adhesion?—It is the union of parts that have been divided, through the intervention of coagulable lymph.

What is effusion? — Effusion is the pouring out of a liquid (generally serum or lymph), in the cellular membrane, or into the cavities of the body.

What is suppuration? — The formation of a straw-coloured fluid called pus.

Does pus ever become changed in its character and appearance? — It does.

What are the appellations and characters of unhealthy pus?— Ichor, a thin, acrid fluid; sanies, a bloody, offensive ichor; sordes, a leaden-coloured, very offensive fluid, apparently partially coagulated.

What are the symptoms denoting the formation of pus? — An aggravation of all the inflammatory symptoms, followed by rigors or shiverings, and a subsidence of pain, heat, and redness; and the sense of fluctuation in the swollen part.

What is an acute abscess? — A collection of pus, contained in a circumscribed cavity or cyst formed by inflammation.

What may render abscesses dangerous? — Their size or number, or their being situated in vital parts.

How are acute abscesses to be treated? — Suppuration should be encouraged by warm poultices and fomentations; and as soon as fluctuation is perceived, the pus must be evacuated by puncturing the abscess with the lancet or bistoury.

What constitutional means are to be employed? —Alterative medicines, generous, but unstimulating diet, with tonics, especially in chronic or extensive abscesses.

What is a frequent accompaniment of extensive suppuration? — Hectic fever, characterized by a chill, followed by flushes of heat, terminating in sweats, frequently profuse, and particularly troublesome at night; small quick pulse; circumscribed flush of cheek; burning sensation in the palms of the hand and soles of the feet, diarrhœa, &c.

How is the opinion that hectic arises from the absorption of pus disproved? — By the fact that it frequently arises from constitutional irritation where no pus exists.

Can hectic be removed? — Not without removing the cause.

What is the treatment to be pursued? — Palliatory; consisting chiefly of bark, wine, digitalis, opium, vegetable diet, and the mineral acids.

What is a chronic abscess? — One arising from a low degree of inflammation. The pus is serous generally. This form of abscess is most frequent in those of a feeble and scrofulous constitution, and is attended generally with little or no pain, redness, or swelling. It may become distended, ulcerate and discharge.

What is the treatment? — An invigorating diet, with cordials and stimulants. Produce, if possible, absorption of the pus by blisters and iodine, applied locally; if the absorption cannot be effected, open it with care; if small, open freely and discharge all the pus, and then apply pressure; if the abscess is large, make small valvular openings to prevent the introduction of air, and then apply compresses.

What is meant by termination by hemorrhage? —Where the coats of the blood-vessels are destroyed, and blood poured out.

What is ulceration? — Solution of continuity in the soft parts, produced by inflammation.

What is an *healthy* ulcer? — A granulating surface secreting pus; the granulations being firm, florid, equal in size, very slightly elevated above the surrounding surface, and covered with patches of lymph.

How is this ulcer to be treated? — It should be dressed with simple cerate, or water dressings, or a light poultice applied cold; the edges are to be supported by a roller, or by adhesive strips; and, if the ulcer be upon a limb, the limb must be in the horizontal position.

How may *irritable* ulcer be known? — It is known by the inequality of the granulations, which are frequently dark or fiery red,

extremely painful and tender, and discharging a bloody pus, with ragged and inflamed edges.

Under what circumstances, and in what situation does irritable ulcer occur?—It generally occurs in persons of irritable nervous habit, particularly high livers, and generally occupies the outside of the leg just above the ankle.

What is the treatment to be adopted?—Calomel, and opium internally; rest with the limb elevated; application of nitrate of silver, afterwards of a raw carrot poultice, or a warm bread and milk poultice, or of an ointment composed of unguentum cetacei, and unguentum hydrargyri, each half an ounce, with one drachm of powdered opium.

How may the *indolent* ulcer be recognised?—By its indisposition to heal; its loose, flabby, pallid, and sometimes fungous granulations, which are dry, or covered with a glairy, viscid, and cohesive matter, and with round, soft, and smooth edges.

From what does this ulcer arise?—From neglect, or from a shattered constitution, by which an ulcer, at first healthy, is rendered indolent.

What local treatment is requisite?—The edges must be pared away, and the surface touched lightly with nitrate of silver, or a solution of nitric acid, or with a decoction of oak bark; or sprinkled with powdered rhubarb, or red precipitate; or covered with red precipitate ointment or basilicon; and the limb elevated, and surrounded with a roller; the edges being kept near each other by adhesive strips.

What constitutional means are to be used?—Mercurial alteratives, wine, carbonate of ammonia, opium, and general tonics.

What is granulation?—That process by which solution of continuity, formed by wounds or ulceration, are repaired by the production of new substance in the form of conical elevations, called granulations.

How many kinds of granulations are there?—Two; healthy, of a fine red colour, of the size of a grain of wheat, covered with patches of coagulable lymph; and unhealthy, large, flat, and flabby, or of an inordinate or fungous growth.

What is cicatrization?—That process by which a wound or ulcer, in healing, is covered with a new skin.

What is mortification?—The loss of vitality in a part in consequence of inflammation.

How has mortification been divided?—Into gangrene or incipient mortification; and sphacelus, or complete death of the part. (This division, however, is not generally retained.)

What are the signs of mortification?—Diminution of the heat and sensibility of the part, livid discoloration of the skin, with elevation of the cuticle in the form of vesicles, containing a thin serum, crepitation from air in cellular tissue, great prostration, typhoid pulse,

brown tongue, low delirium, nausea, subsultus tendinum; finally, the circulation, heat, and sensibility of the part entirely cease, the skin becomes black or very dark, and the patient sinks suddenly, or sometimes recovers.

Where the patient survives, what change takes place at the part affected? — A line of demarcation or separation is formed between the living and dead parts, and the sphacelated portion is separated by ulceration.

What are the constitutional remedies to be adopted in the treatment of mortification? — Musk, camphor, opium, carbonate of ammonia, the mineral acids, bark, wine, and generous diet.

What are the local remedies? — Warm poultices, with yeast, or powdered charcoal, or carbonated water to correct the fœtor; lime water and linseed oil. Blisters have also been recommended to be applied so as to cover the whole of the affected and a portion of the sound part; and also scarification of the mortified part.

What is chronic mortification? — A peculiar kind, generally attacking old persons; commencing in the form of a bluish spot on one of the toes, followed by separation of the cuticle, and gradual extension of the disease; sometimes accompanied by severe pain, until the patient finally sinks with the general symptoms of mortification.

What is supposed to excite this disease?—It is generally attributed to ossification of the arteries.

What is the treatment to be adopted? — Tonics and opiates as general remedies, and bread and milk, or yeast poultices, and blisters locally.

Is amputation advisable? — It is not; as it would be generally followed by mortification of the stump.

What is dry mortification? — A peculiar form of mortification generally attacking the feet, which gradually lose their vitality, and become converted into a dark coloured, dried-up mass, resembling, in appearance, a dried anatomical preparation; generally without fœtor or sloughing; although sometimes accompanied with acute burning pain.

What is the prognosis of this disease? — Not so unfavorable as in chronic mortification.

What is the cause of this disease?—It is not certainly known; but it has been attributed by some to the use of damaged grain, especially that containing secalè cornutum.

What method of treatment is to be pursued?—Blister externally; iodine internally; but amputation is generally the only effectual remedy.

ERYSIPELAS.

What is erysipelas? — An inflammation of the skin and subjacent cellular tissue, characterized by an exanthema or eruption, elevated, of a bright red colour, disappearing under pressure; with sometimes vesicles containing an amber-coloured serum.

What other forms does erysipelas assume?—1st. *Phlegmonous*, characterized by vivid redness diminishing from the centre; swelling, hardness, burning, and throbbing pain; with quick, hard pulse, and coated tongue; 2d. *Œdematous*, characterized by tumefaction, not so hard as in the former variety; the skin smooth and shining, and pitting on pressure. This form attacks the scrotum and loose cellular tissue, and sometimes the face, accompanied by delirium or coma, and vomiting; and sometimes terminating in gangrene.

What varieties does simply erysipelas sometimes exhibit?—It is sometimes erratic, and occasionally terminates in metastasis to some internal organ.

What is the prognosis in erysipelas?—In the simple variety it is favourable, as it generally terminates in resolution and desquamation of the epidermis; in the œdematous form it is more grave, particularly when it attacks the head; in the phlegmonous form the prognosis is often very unfavourable if allowed to proceed to suppuration, the pus forming extensive sinuses under the skin, and the patient falling a victim to the constitutional disturbance.

What are the causes of erysipelas?—It frequently arises without any apparent cause, when it is said to be idiopathic; but it often follows wounds or operations, when it is called traumatic erysipelas.

What is the proper treatment in this disease?—Mercurials and antimonials, followed by sulphate of quinia, which has been highly recommended; opium too is often serviceable; leeching to the neighbouring sound parts is preferable to bleeding; blisters, and cold applications, as well as depletion, should be used very cautiously, especially when the head or face are implicated; mercurial ointments, acetate of lead, tincture of iodine, and nitrate of silver, are among the best local applications; and in the phlegmonous form free incisions should be used to prevent the pus from burrowing in the cellular tissue.

PERNIO, OR CHILBLAINS, AND FROSTBITE.

What are chilblains?—An inflammatory affection produced by cold, or a sudden transition from heat to cold, accompanied with redness and an intense itching, and sometimes becoming ulcerated and difficult to heal.

What parts of the body do they generally attack?—The heels, toes, fingers, ears, nose, and lips.

What remedies are recommended?—Ice water and snow, liniment, carded cotton, alum curd, a solution of nitrate of silver, or sulphate of copper, copaiba, tincture of iodine, and, in ulcerated cases, chloride of lime in solution, lime water and linseed oil, citrine ointment, or basilicon and red precipitate.

What is frostbite?—Mortification of a part from intense cold.

How is it known?—By the skin becoming livid or white after exposure to cold, and sometimes vesicating.

How is it to be treated?—By rubbing the part with snow, or ice-water until the circulation is restored, (the application of heat is always injurious,) and then applying stimulus.

FURUNCULUS OR BOIL, AND ANTHRAX OR CARBUNCLE.

What is furunculus or boil?—A hard, painful, and inflamed tumour, indolent in progress, having a hard central core, and terminating in suppuration.

What is its proper treatment?—Poultices and warm fomentations until suppuration occurs, and then stimulating injections into the cavity, if it should be slow in filling up.

What is anthrax?—A deep, circumscribed abscess of malignant character, terminating in gangrene.

What are its causes?—It sometimes arises from contact of animals that have died of disease, but occurs often spontaneously.

What is the proper treatment?—Poultices locally, and opiates until suppuration or sloughing takes place, and then the free application of caustic, and, internally, stimulating tonics.

SCALDS AND BURNS.

What are the constitutional symptoms produced by a severe scald and burn?—Great prostration, dyspnœa, and shivering, with sensation of extreme cold; followed, when reaction takes place, by considerable fever.

How is a simple burn, with little or no elevation of the cuticle, to be treated?—It must be enveloped in raw cotton, or covered with a mixture of linseed oil and lime water, or of white of eggs and sweet oil, or a solution of gum arabic.

What is requisite in severe or ulcerated burns?—The serum must be evacuated, and the burn dressed with a poultice, or with strips of linen covered with a solution of linseed oil and lime water, or sprinkled with powdered chalk, or zinci carbonas.

When the burn is very extensive and produces great prostration, what is the proper treatment?—Carbonate of ammonia, or wine, whey, or other stimulants should be administered, and the burn dressed with turpentine alone, or with unguentum resinæ, or with alcohol, or solution of chloride of soda.

How is the restlessness and pain to be relieved?—By opiates, after reaction has been restored.

How are the fungous granulations in severe burns to be treated?—They must be removed by the knife or by caustic, and afterwards dressed with an ointment of hydrargyri oxidi rubrum.

What is the prognosis in burns?—Generally favourable; but a burn comparatively slight, if covering an extent of more than half the body, is almost necessarily fatal, from inability to bring about reaction.

WOUNDS.

What is a wound? — A solution of continuity in a soft part, produced by some mechanical agent.

How are wounds divided? — Into incised, contused, lacerated, punctured, penetrating, poisoned, and gunshot wounds.

What is an incised wound?—A wound inflicted by a sharp, cutting instrument.

What is the prognosis of incised wounds? — They are more or less dangerous in proportion to the size and number of the blood-vessels cut, and the quantity of blood lost.

How are incised wounds to be treated? — If blood-vessels of any size, or which bleed profusely, be cut, they are to be drawn out by a tenaculum or artery forceps, and a ligature thrown around each extremity; the wound is then to be cleansed of blood and foreign matters, and its lips brought together by sutures or strips of adhesive plaster, or silk covered with a solution of ichthyocolla or collodion, leaving spaces between the plasters for the escape of pus; or by a roller bandage.

What should be done with the ends of a ligature after it has been tied? — One of them should be cut off near the knot, and the other left hanging out of the wound.

What is the objection to cutting off both ends of a ligature?—The wound heals over them, but an abcess is afterwards formed for their discharge, and delay is thus occasioned.

How long is it, generally, before ligatures come away? — From six to twelve days.

If it be impossible to take up the artery at the wounded part, what is to be done? — Compression must be made upon the main trunk or vessel supplying the part, by means of a tourniquet, or by twisting a handkerchief knotted over the vessel to be compressed, or by pressure with the hand, until the internal trunk supplying the part can be cut down upon and tied.

What kind of ligatures are employed, and how are they used?—The best kind are those of saddler's silk, or fine packthread, which should be waxed, tied securely, and one end cut off, leaving the other hanging out of the wound to facilitate its subsequent extraction, and sometimes the animal or leather ligature and leaden one are used.

Is it ever necessary to throw a ligature around a vein?—It is only necessary in very large veins, and is attended by considerable danger of inflammation.

What method of arresting hemorrhage has been attempted to supersede the ligature?—Torsion, or twisting the inner coat of the artery by means of forceps.

Is this method effectual? — It has succeeded in arteries of small size, but is not to be depended on in large vessels.

From what circumstance did this operation suggest itself? —From

the fact that lacerated wounds, even of large arteries, seldom bleed much.

What other means of stopping hemorrhage are sometimes employed? —The application of cold, of sponge, powdered agaric, or brameria, and sometimes the actual cautery.

When are these employed?—When the blood oozes from a surface, or profuse bleeding takes place from vessels too small to be secured.

How do all these methods arrest hemorrhage? — By the formation of coagula in the mouths of the divided vessels, the inner coats of which are retracted and diminished in calibre.

Of what are sutures made and how are they used? — They may be made of the same material as the ligatures, and are generally used in the form of interrupted suture, or of the twisted or hare-lip suture and Glover's.

How is the interrupted suture made? — By arming a ligature with a curved needle at each extremity, and pushing them through each lip of the wound; the wound is then drawn together, and the ligature tied in a knot.

How is the twisted suture formed? — By passing a needle or silver pin, armed with a steel point, through the opposite edges of the wound, and bringing the edges together by passing the ligature alternately around each extremity of the pin, in the form of a figure eight (8).

What further treatment do incised wounds require? — Merely to be kept moist by a water-dressing (compresses soaked in water), or by a dressing of simple cerate.

What is the usual mode of union of incised wounds? — Union by the medium of the coagulable lymph of the blood, without suppuration. (This is denominated *union by the first intention.*)

What is a contused wound? —One inflicted by a blunt instrument, which produces a wound with bruised edges, and with little or no hemorrhage.

How are these wounds generally healed? — By granulations.

How are contused wounds to be treated? — Sutures and pressure with bandages must be avoided, and union by the first intention attempted to be brought about, which, however, is seldom possible; in this case we must encourage suppuration by poultices, &c.

What is a contusion? — A bruise without loss of continuity, indicated by discoloration, from extravasation of blood beneath the skin.

How is it to be treated? — By leeches, cold lead-water, rest, &c.

What is a lacerated wound? — One which is torn rather than cut; inflicted generally by an instrument with a ragged edge.

Is the hemorrhage often great in these cases? — No; not even when large vessels are torn across.

To what is this to be attributed? — To the torn edges of the artery being very favourable to the formation of a coagulum.

How are lacerated wounds to be treated? — Foreign substances

must be removed, and union by the first intention (which sometimes occurs in these cases), must be attempted to be brought about; and this failing, they are to be dressed with poultices or water-dressings, and the general state of the constitution is to be attended to.

What is a punctured wound? — One inflicted by a sharp, narrow, pointed instrument, as a thorn, a splinter of wood or bone, the point of a scalpel, &c.

What is the principal danger from punctured wounds? — The formation of pus under the fascia; inflammation of the lymphatics and their glands; spasmodic twitchings, and sometimes tetanus from injury of a nerve.

What is the proper treatment? — In ordinary cases a simple poultice is sufficient, with extraction of the foreign substances; if bad symptoms show themselves, we must have recourse to free incisions, to divisions of the injured nerve, to blisters, and to the administration of opium, purgatives, sometimes stimulants, &c.

How do penetrating differ from punctured wounds? — In extending further below the surface, and frequently giving rise to internal hemorrhage, which is very difficult or impossible to be arrested.

What are poisoned wounds? — Wounds accompanied by the introduction into the system of animal or other poisons; as from the sting of the bee, the bite of a rabid dog, or poisonous serpent.

How should these wounds be treated? — When arising from the sting of a bee or other insect, the local application of aqua ammoniæ, or of a solution of acetas plumbi, or of the juice of onion, will generally prove sufficient; in bites of serpents, &c., the wound should be sucked by the mouth or by cups, and then the wounded part should be excised and cauterised. A ligature should also be thrown around the limb above the part bitten. If from the bite of a rattlesnake or other serpent, or from poisoned arrows, the free use of iodine or iodide of potassium, applied locally and continuously, in addition to the cupping-glass and excision of the part, has been found by Dr. Brainard, of Chicago, to promise more than any other treatment. [See Smithsonian Report, 1854.] The Cannabis Indica has lately been recommended.

What is the treatment in hydrophobia?—Excising the part, applying the cupping-glass, cauterising the wound, applying iodine freely. When the disease is fully established, there is little hope of cure; the patient may be relieved by the free and constant inhalation of chloroform, or ether.

What are the consequences of dissecting wounds? — Sometimes a simple pustule, slightly elevated, with redness, burning, and itching, discharging thin pus; from this lymphatic inflammation may follow, which may terminate in suppuration, with typhoid fever as a constitutional affection.

What is the treatment in such cases? — The application of stimulating poultices of tar, yeast, or lye; afterwards opening the pustule

freely and applying caustic. When the lymphatics are affected, leeches, cold applications, and applications of iodine locally. Blood-letting, if the fever is high. If there is extensive suppuration, opening by free incisions, and supporting the strength of the patient, especially if typhoid fever supervenes, by stimulants, good diet, pure air, and allaying pain by opiates.

What is the character of the wound produced by a musket-ball or similar projectile? — It is in the form of a tube, the sides of which almost invariably slough, owing to the wound being contused, from the forcible introduction of a blunt instrument or ball.

What is the character of the openings made by a ball? — The one at which it enters is smooth and regular, owing to the ball passing from a rare to a dense medium, and the opening by which it makes its escape is larger and ragged, owing to its passing from a dense to a rare medium.

How are gunshot wounds dangerous? — By their producing extensive lacerations, fractures, and contusions, by penetrating important organs, or lacerating large blood-vessels.

How are musket-balls sometimes diverted from their course?—By striking obliquely upon a bone, they have been made to pursue a circular course around it, and make their escape at a point opposite that at which they entered.

What is the treatment of gunshot wounds? — The hemorrhage must first be arrested, and the ball extracted by means of a forceps, or by an opening made immediately over it, the wound dressed with water-dressings or poultices, and the constitutional symptoms watched with great care.

How may the course of a ball be ascertained? — By the finger, or by a bullet-probe, or forceps, or scoop, or wax bougie; or, if it has travelled under the skin, by a red line of inflammation appearing a day or two after.

What caution is to be observed? — To avoid unnecessary probing, and not to cut down to the ball, unless it be within a little distance of the surface.

What remarkable property is there belonging to a leaden bullet?— It creates little or no inflammation unless it be lodged in a bone, or just beneath the skin; the parts healing readily around it and forming a cyst.

What peculiarities are exhibited by wounds and injuries of the scalp? — A remarkable tendency to erysipelatous inflammation, and to the development of neuralgic pains and nervous twitching, and great constitutional irritation.

How are these injuries to be treated? — The hair is to be shaved off from the part, and the wound treated as in ordinary cases.

How are gunshot wounds of the head dangerous? — By producing fractures of the skull and injury of the brain, often proving fatal.

What caution must be observed? — Not to be too officious in

searching for a ball that has penetrated the substance of the brain, lest we increase the mischief.

Is the ball to be extracted in any case?—It may be cut down upon with the trephine, if it is known to be immediately under the bone.

What sympathetic affection sometimes follows injuries of the head? — Abscess of the liver.

What injuries may arise from wounds of the face? — Destruction of the eye itself; injury of the orbit, giving rise to fungus, and protrusion of the eyeball; protrusion of the iris through a wound in the cornea; amaurosis from injury of the supra-orbitar nerve; deformity from wounds of the nose, lips, and ears; salivary fistula, from division of the parotid duct; and injury of the tongue from the teeth, or fragments of a bone, or a bullet being driven into it.

How should wounds of the tongue be treated? — The foreign substances should be removed, and the edges of the wound drawn together by the interrupted suture; the teeth being kept asunder to avoid injury to the tongue.

What may render wounds of the neck dangerous? — Division of the carotids of the thyroid gland, or of the lingual or thyroid arteries (giving rise to sudden and fatal hemorrhage), or of the eighth pair of nerves, giving rise to dyspnœa or suffocation.

What caution is to be observed in wounds in which the trachea or œsophagus is divided? — The patient should be nourished through a catheter or stomach tube, to prevent the escape of the food through the sides of the wound.

What deformities sometimes arise from extensive wounds of the neck? — Deformities and contractions from irregular union of the edges of the wound.

How may this be prevented? — By supporting the head of the patient by a stock; through a hole in front of which the wound should be dressed.

How are wounds of the chest dangerous? — By perforating the heart or large vessels, or intercostal or scapular arteries, giving rise to fatal hemorrhage; or of the pleura, giving rise to collapse of the lung, to pleurisy, or emphysema of the subcutaneous cellular tissue; or of the pericardium, giving rise to pericarditis; or from the forcing of foreign bodies, as buttons, spiculæ of bone, or fragments of clothing into the cavity of the chest, giving rise to suppuration; or from perforation of the lung itself, giving rise to hemorrhage, to inflammation and suppuration.

Are wounds penetrating the cavities of the heart necessarily fatal? — They are, although patients have sometimes lived days, or even weeks, after the injury.

How is profuse hemorrhage from the lungs or intercostal arteries to be treated? — Blood is to be drawn from the arm until the hemorrhage from the lung or intercostal artery be moderated; the foreign

substances are then to be extracted, if possible; the wounded vessel must then be secured by a compress, and the chest surrounded by a roller, and perfect rest enjoined.

How may foreign bodies be sometimes extracted from the cavity of the chest? — By injections of tepid water through the opening into the chest.

How are wounds of the abdomen dangerous? — From injury of the peritoneum, producing severe and obstinate inflammation; from perforation of the stomach, intestines, kidneys, liver, spleen, or large vessels, producing dangerous and frequently fatal effusion of blood or fæces, &c., into the cavity of the peritoneum.

Are wounds of the intestines or peritoneum necessarily fatal?—No; they have often been pierced by a sharp-pointed instrument, or by a musket-ball, without being followed by any bad effects, owing to an effusion of lymph, which fills up the perforation and unites the sides with the adjoining parts.

How may a perforation of an intestine be known? — By the escape of food or fæcal matters through the external opening, or the passage of blood per anum.

What are the signs indicating effusion into the cavity of the abdomen? — Great and sudden prostration, a weak, wiry pulse, collapsed countenance, clammy sweat.

Are wounds of the bladder generally fatal?—They are not; unless an effusion of urine takes place into the cavity of the abdomen; the wound sometimes may heal with the ball remaining in the bladder.

What precaution is necessary in wounds of the bladder, to prevent urinous infiltration of the surrounding tissues? — A catheter should be introduced through the urethra, and allowed to remain until the wound is healed.

How are wounds of the abdomen, accompanied by protrusion of intestines or omentum, to be treated? — The intestine must be restored, for which purpose the wound may be somewhat dilated, if necessary.

How are wounds of the intestines or bladder, requiring the suture, to be treated?—When sutures are necessary, the interrupted one is to be used, or the perforation, if it be not large, may be surrounded by a ligature and drawn up like the mouth of a purse, and both ends of the ligature cut off; or, if the intestine be entirely severed, the edge of one portion should be inverted, so that the two peritoneal surfaces may be united.

How are the wounds of the stomach to be treated? — The general inflammatory symptoms are to be combated, and ligatures are not to be used, unless absolutely necessary; in which case it is best to stitch the edges of the wound in the stomach to the surrounding soft parts.

What becomes of the ligature?—It gradually finds its way through the coats of the intestine, and is discharged per anum

How are the wounds of the liver, spleen, and kidneys to be treated? —Nothing can be done but to combat the resulting inflammation.

What disagreeable effects sometimes result from wounds of the genital organs? — Sloughing of the scrotum, or fungus of the testicle.

How are these to be treated?—By removing the diseased parts, and poulticing, &c.

How should wounds of the penis be treated?—The arteries should be picked out and tied, or compressed by introducing a catheter into the urethra, and compressing the penis upon it by a bandage; and if the urethra be divided, the catheter should be kept there until the wound is healed, to prevent sloughing from contact of the urine.

What peculiar danger attends wounds of joints?—Severe, and, very often, fatal inflammation of the synovial membrane.

What peculiar treatment is demanded? — The wound should be closed immediately, and the inflammation combated by general and local bleeding, blisters, purging, opiates, elevation of the limb, &c.

What is frequently necessary in wounds of the joints?—Amputation of the limb.

PARTICULAR ABCESSES.

ABCESS OF THE ANTRUM MAXILLARE.

What is abcess of the antrum? — A collection of fœtid, unhealthy pus in the antrum maxillare.

What are the symptoms? — Deep-seated, severe pain in the part of the face corresponding to the antrum.

What is the cause of this affection? — Generally irritation, and ulceration into the cavity of the antrum, produced by the roots of the teeth.

What is the remedy?—Extraction of the teeth producing the affection, and tapping the abcess by perforating the floor of the antrum; and after the matter has been evacuated using astringent injections.

MAMMARY ABCESS.

What are the symptoms of mammary abcess? — Swelling, severe throbbing pain and distension of the part; continuing often for weeks, and terminating in suppuration, denoted by the usual signs.

What are the causes of abscess of the breast? — Cold, injuries or distension of the breast with milk, or a blow upon the part.

What treatment is to be pursued? — Cupping or leeching to prevent suppuration; if not possible to effect this, poultices, and opening the abscess when fluctuation is perceived, suspending the breast in a sling, or supporting it by adhesive strips. (If sinuses occur, they are to be laid open, and touched with caustic, or stimulating injections used.)

ABSCESS OF THE LIVER.

What are the symptoms of abscess of the liver? — Pain and swelling in the region of the liver, inability to lie upon the affected side; and, finally, fluctuation.

From what causes does it arise? — From hepatitis, from injuries of the liver, or obstruction of the gall ducts.

How is it to be treated? — By the usual constitutional means, and, when necessary, to tap the abscess with a trocar or bistoury as soon as any swelling is perceived, to prevent its bursting internally, in which case it is almost invariably fatal.

What caution is necessary to a patient recovering from hepatic abscess? — Not to indulge too freely in eating, as this is sometimes productive of fatal relapse.

PSOAS, OR LUMBAR ABSCESS.

What is psoas or lumbar abscess? — Secretion of pus from the cellular substance, or ulceration of the vertebræ and soft parts near the psoæ muscles.

What are its symptoms? — Pain in the lumbar region, extending toward the thigh and in the course of the spermatic cord, sometimes attended with retraction of the testis; contraction of the flexors of the thigh; and the appearance of a fluctuating tumour under Poupart's ligament, or under the fascia lata femoris, or between the bladder and the rectum; together with hectic, or the usual signs of suppuration.

What is the prognosis? — Unfavourable; the patient frequently sinking from hectic.

What are the indications for treatment? — To prevent suppuration, if possible, by cupping, leeching, and blistering; and if suppuration occurs to support the constitution, and draw off the pus gradually, at two or three sittings, by a small puncture.

FEMORAL ABSCESS.

How are abscesses under the fascia lata femoris to be treated? — If repeated blistering should not answer, they are to be evacuated by puncture with a lancet; and the thigh tightly bandaged.

PARONYCHIA, OR WHITLOW.

What is paronychia or whitlow? — An abscess, generally commencing in the vicinity of the nail, and travelling under the sheath of the tendons, and sometimes up the arm.

What are its symptoms? — Acute throbbing pain, and swelling, with a very painful sense of tension in the affected part.

How does the disease sometimes terminate? — In necrosis, and loss of one or more phalanges.

How is it to be treated? — Blisters are sometimes useful, but the

only effectual mode, generally, is to lay open the part to the bone with the knife.

What other form of whitlow is there? — Onychia maligna, affecting principally the immediate vicinity of the nail, and giving rise to fungous granulations.

How is this form to be treated? — The nail must be removed if it increases the irritation, and the fungus touched with sulphate of copper or nitrate of silver, and afterwards dressed with a mixture of equal parts of copaiba and tinct. opii or tar.

What are the causes of paronychia? — It arises frequently from the prick of a needle, or thorn, or spiculum of bone; but sometimes from venereal taint.

SPECIFIC DISEASES.

SCROFULA.

What do you understand by scrofula? — That peculiar constitutional taint manifested by enlargement of the lymphatic glands, and a general cachectic condition of the system.

What are its causes? — Most generally the disease is hereditary, or induced by impure air, want of exercise, bad diet, clothing, and indulgence in the depressing passions of the mind, &c.

What is the treatment of scrofula? — It should be hygienic in a high degree, and a resort to the vegetable alteratives as mezereum, sarsaparilla, &c., or the preparations of iodine, iron and cod liver oil.

What is necessary in case of scrofulous ulcer, in addition to constitutional treatment? — Mild ointments, iodine cataplasm, alterative washes, nitrate of silver, &c.

CANCER.

What is cancer? — A peculiar malignant growth, affecting more especially the mammæ and uterus in females, and the penis, testicles, and lower lip in males.

What are the causes of cancer? — Of the immediate causes we know little. (For the latest theories in regard to it we would refer to Muller's Physiology and Carpenter's Physiology, where the doctrine in regard to change of cells is taught). The exciting causes are a blow or fall upon the part, or the action of any external irritant.

What are the two stages of cancer, and how are they known? — The first is that of *scirrhus* or hardening of the soft parts, the second is that of open cancer, or ulceration. The first is known by a preternatural hardening of the soft parts, not easily resolved; the tumour is unequal on the surface, the skin covering it is blue, or of a leaden hue, the pain is vehement and oftentimes compared to the gnawing of an animal. This condition may exist for some time before ulceration takes place, which produces a foul fungous sore, with a surface dark red and glassy, and the margins elevated, everted, and irregular.

What is the treatment of cancer? — As soon as the disease developes itself, it should immediately be dissected out if possible; (even this, however, rarely succeeds). The pain should be assuaged by the usual anodynes, both externally and internally.

What are the various preparations which have been used to eradicate the affection?—Those of iron and arsenic, iodine, conium, zinc, corrosive sublimate, and the extract of poke root, &c.

What caution is requisite in removing a cancerous or otherwise diseased testicle? — Not to divide the cord by a single incision, but by a series of cuts; tying each artery as it is divided, lest the cord shrink within the abdomen before the hemorrhage is arrested.

FUNGUS HEMATODES.

What is the character of fungus hematodes? — It is a malignant tumour, attacking any part of the body; sometimes remaining for a long time stationary, elastic, and imparting a deceptive sense of fluctuation to the touch; increasing with great rapidity, when in a state of activity, and finally ulcerating through the skin in the form of a dark red fungus, extremely vascular, and bleeding profusely when cut, or sometimes spontaneously.

What treatment is proper in this disease? — The only hope of removing the disease lies in the amputation of the limb on which the tumour is situated, or excision of the part; and even this very frequently is unsuccessful, from the return of the disease.

GONORRHŒA.

What is gonorrhœa?—An inflammatory discharge from the mucous membrane of the urethra, glans penis, and prepuce in men, and of the urethra and vagina in women; arising from impure connection, and capable of being communicated by contact.

With what other discharges is it sometimes confounded? — With blenorrhagia, or simple mucous discharge, not communicable by contact, but oftener (in women) with leucorrhœa.

How may vaginal gonorrhœa be distinguished from leucorrhœa? — By many it is thought impossible to do so; but on examination with a speculum per vaginum, erosions or superficial ulcers of the mucous membrane may be sometimes detected in gonorrhœa.

Is the matter of gonorrhœa capable of giving rise to chancre, or symptoms of constitutional syphilis?—It is not.

From what has the contrary opinion arisen? — From *larvated* or hidden chancres existing in the urethra at the same time with gonorrhœa.

What are the principal symptoms of gonorrhœa?—Redness of the mouth of the urethra, prepuce, and glans; discharge of fluid, at first thin and white, but afterwards thicker, and yellow or greenish, and of peculiar smell; scalding pain on passing the urine; sometimes tenesmus, and chordee or painful spasmodic erection of the penis.

How does gonorrhœa sometimes terminate? — When not cured, it frequently degenerates into gleet, or a scanty whitish discharge, difficult to cure.

How should gonorrhœa be treated? — When acute inflammation is present, leeches and general antiphlogistic remedies should be used; and after the inflammation is subdued, or the disease has assumed the chronic form, the internal administration of cubebs, copaiba, or uva ursi; or local injections of solutions of tannin (three grains to the fluid ounce), or of acetate of lead, sulphate of zinc, nitrate of silver (one to six grains up to forty, to the fluid ounce), or chloride of zinc, or of iodide of iron (half a grain to the fluid ounce), will be useful.

Why are astringent injections prohibited in the inflammatory stage of gonorrhœa? — From the danger of producing swelled testicle.

Is mercury at all necessary or useful in this disease? — It is not.

What article is highly recommended as an internal remedy in the inflammatory stage of gonorrhœa? — Copaiba, in the dose of one or two drachms.

What treatment is adapted to relieve or prevent chordee? — The administration of opium and camphor in combination with lupullin, in the proportion of one grain of opium to three of camphor, or of extract of hyosciamus and camphor, in the proportion of two grains of the former to three of the latter; to be taken nightly.

What affections frequently result from gonorrhœa? — Phymosis, paraphymosis, strictures of the urethra, and sometimes sympathetic (not syphilitic) buboes.

What is meant by balanitic or spurious gonorrhœa? — A gonorrhœal inflammation of the glans penis.

What treatment is required? — Cooling lotions, or nitrate of silver passed lightly over the inflamed surface.

What treatment is required in gleet? — Astringent injections; injections of a solution of the sulphate of quinine; or the passage of large bougies into the urethra.

How should sympathetic buboes be treated? — By leeching, blisters, and general antiphlogistic remedies.

SYPHILIS.

How is syphilis divided? — Into three stages; primary, secondary, and tertiary.

In what does primary syphilis consist? — In an affection entirely local, characterized by a simple chancre, or excavated sore, with elevated verticle edges, with or without an indurated margin and base; and capable of propagation by venereal intercourse, or by inoculation.

What form does chancre sometimes assume? — That of a phagedenic, or spreading ulcer.

Do buboes ever occur in primary syphilis? — They do, both from sympathy and from absorption.

How may these two kinds of bubo be distinguished? — Bubo from absorption may be known by its being deep-seated, and by its producing a chancre by inoculation with the pus taken from it; sympathetic bubo is seated in the superficial glands, and not generally inclined to suppuration.

What is meant by secondary syphilis? — A constitutional affection following the primary; owing to absorption of the virus into the system, and characterized by scaly, pustular, or papular eruptions upon the skin, leaving copper-coloured blotches after they are healed; mucous tubercles, venereal warts, and ulcerations of the mucous membranes of the mouth, throat, and nostrils.

How may secondary syphilis be transmitted? — It is thought by some to be incapable of being reproduced by inoculation, and only transmitted hereditarily.[1]

What are the symptoms of tertiary syphilis?—Nodes; caries of the bones; deep-seated tubercles of the brain and cellular tissue; and sometimes syphilitic rheumatism.

Is tertiary syphilis capable of being propagated by inoculation, or by hereditary transmission? — It is not generally.

When does the tertiary form of syphilis occur? — Commonly long after the disappearance of the primary symptoms, and in the majority of cases after the disappearance of the secondary symptoms, or while they are still present.

What is the chief indication of treatment in the simple primary ulcer or chancre? — To change the surface of the sore as soon as possible, and prevent the constitutional affection from absorption of the virus.

How is this accomplished?—When the chancre is without induration, it should be gently washed with a solution of tannin (or with the aromatic wine of the French Pharmacopœia), and then covered with lint, moistened in the solution, or with the blackwash; or it may be cauterised with nitrate of silver.

What effect has mercury in this form of chancre? — It is productive of no good, and often increases the tendency to ulceration and secretion.

What is the proper treatment of indurated chancre? — If the suppuration be abundant, the sore should be washed with the aromatic wine, and dressed with a cerate of calomel and opium, or applications of nitrate of silver or sulphate of copper may be employed.

What treatment is required for the phagedenic chancre?—The application of nitrate of silver, or of nitric or muriatic acids; or if the chancre be of a sloughing character, the aromatic wine, or strong so-

[1] According to some very high authorities, mucous tubercle is the only form in which secondary syphilis can be transmitted hereditarily.

lutions of chloride of soda or lime; if very much inflamed, mild anodyne fomentations and poultices; if irritable, carrot poultices, opiate cerate, or nitrate of silver, liquor potassæ arsenitis, or nitric acid may be found useful.[1]

How should chancres in the urethra be treated? — If the accompanying gonorrhœal inflammation be not too great, they should be cauterised with nitrate of silver, by means of Lallemand's instrument; but if the inflammation be intense, it should first be moderated by antiphlogistic treatment.

How should buboes from absorption be treated?—Their development should be prevented, if possible, by the application of blisters, succeeded by a strong solution of corrosive sublimate, and other antiphlogistic applications; but after ulceration, they should be treated like chancres.

What is the general treatment required in secondary syphilis? —It consists in tonics, diaphoretics, baths, and general alteratives, particularly the iodide of potassium, sarsaparilla, and some recommend mercury in the form of protoiodide, particularly in the scaly form of eruption; cod liver oil is also highly extolled.

What treatment is adapted to mucous tubercles and venereal warts? —They should be washed with pure chloride of soda (if they are not ulcerated, or if in that condition, with a solution just strong enough to be felt), and afterwards sprinkled over with calomel, or burnt out by a caustic, consisting of hydrarg. nit. ℥j. and acid. nitric. ℥j. applied gently to the part, and not allowed to run upon the neighbouring parts.

How should ulcerations of the mucous membranes be treated?—By the application of caustics or strong astringents.

What is the constitutional treatment in tertiary syphilis? — The only remedies to be relied on are the iodide of potassium, and the protoiodide of mercury, and cod liver oil.

How should nodes be treated? — The pain may be mitigated by the application of extract of conium or stramonium, and the nodes themselves removed by the repeated application of blisters; or by incisions over them, followed by the application of a blister, and the use of iodine as a dressing to the blistered surface.

In what way may the symptoms of secondary and tertiary syphilis be imitated? — By the poisonous effects of long continued mercurial treatment.

FRACTURES.

What is a fracture? — A solution of continuity in a bone.

How are they produced? — By blows or other mechanical injuries

[1] The aromatic wine consists of four ounces of aromatic herbs, viz.: origanum, salvia or sage, thyme, hyssop, water mint (mentha hirsuta), and wormwood, digested in two pints of red wine for eight days. The opiate cerate consists of a fluid ounce of the vinum opii, to a pound of simple cerate.

applied at the part, or at a distance from it; or sometimes by violent contraction of the muscles.

What disease is frequently a predisposing cause of fracture?—Fragilitas ossium.

How may a fracture be detected?—By the shortening or deformity produced in the limb, by the action of the muscles upon the fragments; by crepitation or grating sound on moving the fragments upon one another, and generally by loss of power in the part.

How are fractures ordinarily divided?—Into *simple*, or those where the bone is broken in a single place, without injury of any other tissue; *compound*, where the fracture communicates with an external wound; *comminuted*, where the bone is broken into small fragments; and *complicated*, where the fracture extends into a joint, or is accompanied by a wounded artery, or a dislocation.

In what directions may a bone be broken?—*Transversely*, generally without much displacement; *obliquely*, with shortening of the limb; and *longitudinally*.

What peculiar kind of fracture sometimes takes place in children?—Separation of the shaft of the bone from its epiphyses.

How are fractured bones united?—Through the medium of lymph, poured out by the vessels of the periosteum, which finally becomes changed into callus, and then into bone, by the deposit of calcareous matter.

How long is bony reunion in taking place?—Generally from forty to sixty days.

What is the prognosis in fractures?—It depends very much upon the age, constitution, or habits of the patient; but is much less dangerous in simple fractures than in any other kind.

What is the general treatment applicable to fractures?—The fractured portions are to be brought together and retained in their natural position, by means of extension and counter-extension, followed by splints and bandages; and the irritation and inflammation is to be subdued by opium, and general and local depletory measures.

What is meant by extension and counter-extension?—Extension is the force applied below the fracture, to draw down a fragment that has overlapped the other; counter-extension is the resistance or force by which the upper fragment is retained in its place during extension.

How long should the fracture be kept bandaged?—Until reunion is perfect.

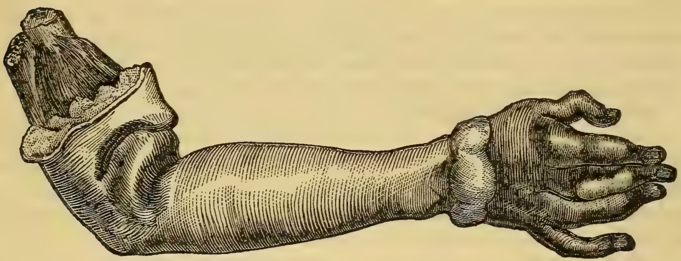
How are bandages used?—In the form of rollers of muslin or flannel, or in strips, as in the many-tailed bandage of Scultetus.

What cautions are requisite?—They should not be applied too tight, lest mortification (Fig. 157) be produced by the pressure.

What kinds of splints are used?—Wooden splints, covered or plain; splints of pasteboard, tin, leather, wire gauze, strips of rattan glued on leather, and hatters' felt soaked in gum shellac, and gutta percha.

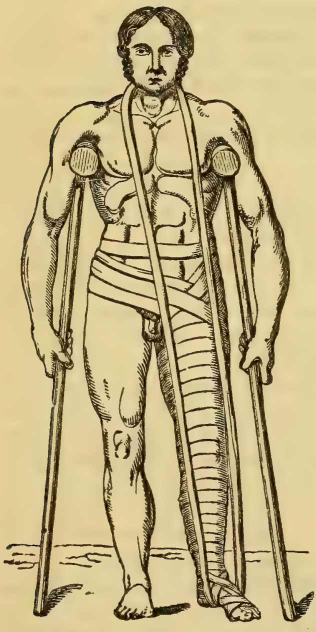
What is the immovable apparatus of Seutin, or of Velpeau? (Fig. 158.) — A combination of the splint and bandage, formed by apply-

Fig. 157.



ing a pasteboard splint to the limb, and enveloping it with a starched roller, which hardens it into an immovable splint, encasing the whole limb.

Fig. 158.



What are the objections to this apparatus? — Its great difficulty of removal; and the collection of pus, or the occurrence even of mortification, without being detected by the surgeon.

What is sometimes formed by the failure of fractures to unite? — Pseudarthrosis, or artificial joint.

How is this to be remedied? — By repeatedly rubbing the fractured ends together; or by cutting down and excising them, or by passing a seton between them, and then treating the fracture in the usual way.

What special treatment is required in compound fractures?—After the fragments have been adjusted, the external wound should be covered with a poultice, or water dressing.

What method is sometimes adopted to convert, as it were, a compound into a simple fracture? — Covering the wound with dry bran, to form an artificial scab.

What operation is very frequently called for in complicated fractures? — Amputation.

What are the effects of fracture of the bones of the nose? — Defor-

mity; and sometimes death from the crista galli of the ethmoid being driven in upon the brain.

How is the fracture to be treated? — The fragments are to be carefully adjusted in their natural situation, by means of the fingers, or by a gum catheter; and the inflammation to be subdued by general and local depletion, &c.

What is the caution with regard to the introduction of foreign bodies, to preserve the shape of the nose? — They should be avoided, as productive of unnecessary irritation.

How is fracture of the jaw to be treated? — The fragments are to be adjusted, and kept in place by a splint moulded to the part, and supported by a suitable bandage, and absolute rest enjoined.

How are teeth loosened in fracture of the jaw to be treated? — They must not be extracted, lest the fracture be converted into a compound one.

What is the prognosis of fracture of the spine? — Fractures of the spinous processes are, comparatively, free from danger; fractures of the bodies of the vertebræ are almost necessarily fatal, from the depressed bone, or extravasated blood pressing upon the spinal marrow.

What is the effect of fracture above the fourth cervical vertebra? — Instant death from paralysis of the respiratory nerves.

What occurs in fracture of the lower vertebræ? — If the lower cervical be injured, paralysis of the arms and difficulty of respiration take place; if the dorsal, torpor, and distension of the intestines; if the lumbar, paralysis of the lower extremities, with involuntary evacuation of fæces.

How is fracture of the spine to be treated? — But little can be done. Care should be taken not to turn the patient upon his face, as instant death is thus often produced; and if the bladder be paralysed, the urine must be drawn off frequently by the catheter.

What are the symptoms in fracture of the ribs? — Depression, or elevation, or overlapping of the fragments, accompanied by painful or difficult respiration.

What complications sometimes exist? — Wounds of the intercostal arteries and emphysema.

How is emphysema from fracture of the ribs to be treated? — The air must be evacuated by puncturation, and a tight roller passed around the chest.

How are ordinary fractures of the ribs to be treated? — The fragments are to be adjusted, and kept in place by compresses (applied over the fracture if the fragments project, or at each extremity of the rib if they be depressed), and a roller applied over them, sufficiently tight to prevent motion of the chest.

How may fracture of the sternum be detected? — By the situation of the pain, and by the crepitation of the fragments during respiration.

What treatment is to be pursued? — The patient should be kept in

an upright or sitting position; the chest surrounded by a tight roller; and the inflammation and irritation subdued by bleeding and opiates.

How is fracture of the clavicle produced?—By a fall upon the clavicle, or on the elbow, with the arm extended; or by a blow directly upon the part.

What are the appearances exhibited?—Falling of the shoulder; inability to raise the arm above the shoulder; inclination of the head toward the affected side; and, generally, mounting of the fragment nearest the sternum upon the other.

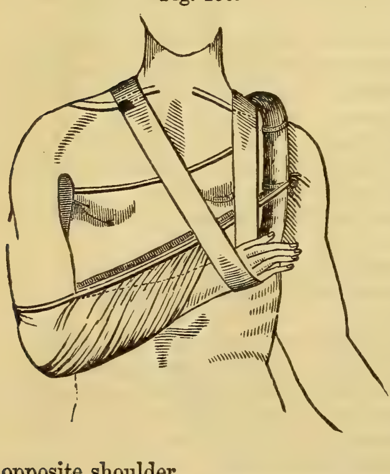
What are the indications of treatment?—To replace the fragments, and retain them in their natural position.

What is necessary for this purpose?—To carry the shoulder upward, outward, and backward, and support it in this position.

What are the forms of apparatus generally employed for this purpose?—They are two, Desault's and Fox's; and one recently introduced by Dr. Levis. (See American Journal, January, 1856.)

Of what does Desault's bandage consist?—Of a large wedge-shaped pad, which is placed in the axilla, with the larger end uppermost, and retained there by a roller, and also of two other rollers; the object of the pad and first roller being to carry the shoulder outward, and to prevent motion of the chest; the object of the other rollers being to carry the shoulder upward and outward, and retain it in that position, and to make compression over the fracture, which must be previously covered by a compress.

Fig. 159.



What are the objections to this apparatus?—Its complicated nature and liability to derangement, and its difficulty of application to females, young children, or fat persons.

Describe Fox's bandage. (Fig. 159.)—It consists of the wedge-compress and first roller of Desault; but for the other rollers a sling cut to fit the arm and forearm in a state of flexion, is substituted, and fastened by tapes to a padded ring surrounding the opposite shoulder

What complication sometimes occurs in fractures of the clavicle?—Wounds of the subclavian artery, or brachial plexus of nerves, by

spiculæ of bone driven down upon them, producing violent nervous symptoms, or hemorrhage.

How may the scapula be fractured? (Fig. 160.)—At the acromion process, at its lower angle, or vertically through its middle.

How is fracture of the acromion to be treated?—By an apparatus similar to that for fractured clavicle.

How does fracture of the acromion unite?—Through the intervention of a ligament.

What derangement takes place in fracture of the lower angle of the scapula?—The lower fragment is drawn forward by the action of the serratus and teres minor muscles.

How is it to be treated?—The fragment is to be drawn back and retained in its position by rollers and compresses.

What treatment does vertical or longitudinal fracture of the scapula require?—From the fragments being retained in situ by the scapular muscles, little or no treatment is required, except, perhaps, a roller.

How may the os humeri be broken? (Fig. 161.)—It may be broken within the surgical neck, in its shaft, or at the condyles.

Fig. 160.

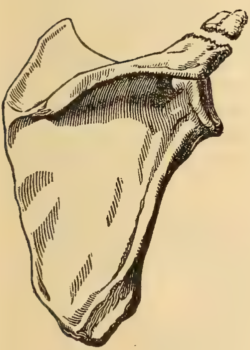


Fig. 161.

What is meant by the surgical neck of the os humeri?—That part of the bone included between its tubercles, and the insertion of the latissimus dorsi and pectoralis major muscles.

How is fracture of the head, or surgical neck of the os humeri to be treated?—By a pad in the axilla, similar to that in Desault's apparatus, to which the arm is secured by a roller, or by the rectangular, and three humeral splints.

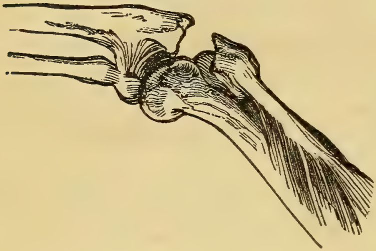
How is fracture of the shaft of the bone to be treated?—The fragments are to be replaced, and then a roller is to be carried round the arm and forearm, from the fingers to the axilla, and three splints applied to the outer, anterior, and posterior sides of the arm, and secured by descending turns of the roller; the pad is then to be placed in the axilla, and secured as in the previous cases.

What special treatment is requisite in fracture of the condyles?—

The application of Dr. Physick's angular splint, which should be removed daily, after the first four or five days, and the angle varied, and passive motion imparted to the limb, to prevent anchylosis.

How may fracture of the olecranon be recognised? (Fig. 162.) — By inability of the patient to extend the limb, and by the separation of the fragments.

Fig. 162.



How is it to be treated? —The upper fragment is to be drawn down, and retained in contact with the lower, by means of a figure eight (8) bandage, and the limb kept extended by a long splint placed in front of the elbow-joint, and after a short time (from fifteen to twenty days), flexion should gradually be made.

What is produced in fracture of the coronoid process? — Dislocation of the ulna backwards upon the humerus.

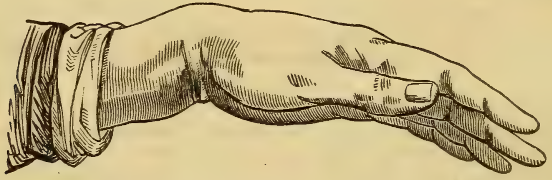
How is it to be treated? — The parts must be restored to their natural situation by extension and counter-extension, and retained so, with the arm flexed by means of bandages and splints.

How are fractures of the radius and ulna to be treated? — The fragments are to be replaced, and the inequalities of the limb filled up by compresses; these are sometimes loosely covered by a roller from the fingers to the elbow; and over this are placed two flat splints, extending from the elbow beyond the fingers, both above and below; and these are to be secured by descending turns of the roller, and the arm supported in a sling — taking care that the thumb appears between the splints in a vertical position.

Why should not the ascending turns of the roller be drawn tightly? — Lest the interosseous space be obliterated, and deformity result.

For what may fracture of the lower extremity of the radius be mistaken? — For dislocation of the wrist. (Fig. 163.)

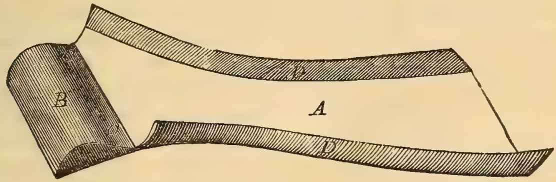
Fig. 163.



How is it to be treated? — Two small compresses are to be applied, the one over the prominence on the back, the other over the project-

ing extremity of the fragment on the under side of the wrist, and then the limb should be placed in Bond's *splint*, (Fig. 164,) or the substitute of Hay's. (Figs. 165, 166.)

Fig. 164.



What danger is to be apprehended from injuries of the bones composing the wrist-joint?—Inflammation, terminating in anchylosis, or giving rise to constitutional symptoms requiring amputation of the forearm.

How should they be treated?—By adjustment of the fragments; by splints, rest, and antiphlogistics.

What is necessary in fractures of the phalanges of the fingers?—

Fig. 165.

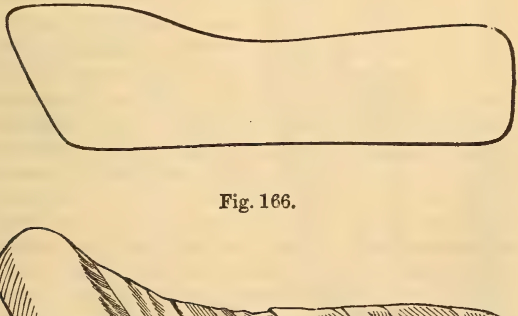


Fig. 166.

Mould the parts to their natural position, and then apply a bandage round the finger, and one on each side. Passive motion should be carefully used to prevent anchylosis or stiff joint. If this, however, should happen, place the finger in such a position as will be most useful.

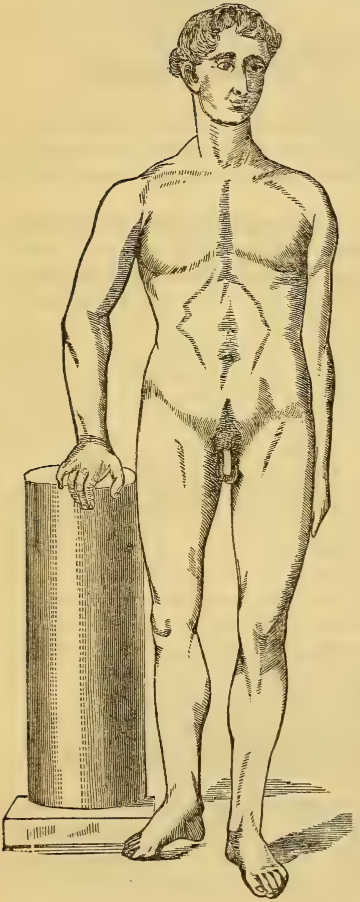
What is the prognosis in fracture of the pelvis?—Very unfavourable.

To what bad effects do they give rise?—To extensive collections of pus, paralysis of the bladder, &c.

What treatment is to be pursued?—Rest, sometimes a bandage around the pelvis, the use of the catheter, if required, and general depletory measures.

How are fractures of the thigh divided?—Into fractures of the neck within the capsular ligament; fractures of the neck without the capsular ligament; fracture of the trochanters; fracture of the shaft; and of the condyles.

Fig. 167.



What are the peculiarities of fracture of the neck within the capsular ligament?—It generally takes place in aged persons, particularly females, and from very slight causes; and from deficiency of circulation is generally incapable of bony reunion. (Fig. 167.)

What are the signs of this kind of fracture?—Shortening of the limb one or two inches by the contraction of the glutæi muscles; eversion of the knee and foot, by the rotators of the thigh; loss of rotundity of the hip; inability to stand upon the fractured limb; absence of pain while in the recumbent position; and want of crepitus, except when the femur is drawn down to its original length.

What sometimes obscures the diagnosis?—The failure of the muscles to produce a shortening and eversion for some time after the receipt of the injury.

What is the prognosis in this species of fracture?—Very unfavourable; recovery seldom taking place for several months, or without permanent lameness, and the accident frequently proving fatal.

What treatment is proper?—The only treatment advisable, is to keep the limb extended, and supported upon pillows.

How may fracture of the neck of the femur, external to the capsular ligament, be known? — By its taking place earlier in life than fracture within the capsule; by being produced by much greater violence; by the crepitus, discernible without drawing down the limb; by the greater degree of pain; and by the extravasation of blood, which generally occurs in these fractures; as well as by eversion of the foot and knee, and loss of rotundity of the hip, as in the former fracture.

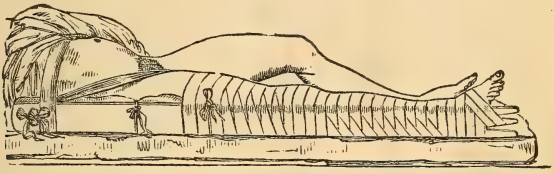
What is the prognosis? — Bony reunion takes place slowly, requiring several months for its completion.

How may the other fractures of the thigh be recognised?—By the shortening of the limb, eversion of the knee and foot, and by the local deformity, crepitation, and pain.

What are the indications to be fulfilled in treating fractures of the thigh? — To overcome the shortening by means of extension and counter extension, and to coapt and retain the fragments in their proper position.

What are the principal kinds of apparatus used for this purpose?— The double-inclined plane; Liston's apparatus (Fig. 168); Desault's apparatus, modified by Dr. Physick; Hartshorne's modification of Desault's; Hagedorn's, modified by Dr. Gibson; and Horner's.

Fig. 168.

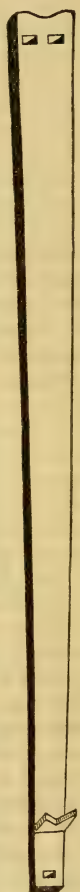


What are the peculiarities of Horner's splint? — We have the original Physick splints of Desault, padded throughout their length, and the inner one, at its upper extremity, is slightly carved out like a crutch-head, and a soft leather strap stretched across it. To the inside of the upper portion two loops are nailed to attach the counter-extending straps. When applied, four or five strips of bandage are laid transversely, and the patient placed directly upon them. The splints are then placed in position, and a bandage passed through the loops at the side and near the upper end of the inside splint, one portion of which is carried beneath the buttock, and the other passes over the groin to the top of the outside splint, where they are tied to make the counter-extension. Extension is then made by a strip of adhesive plaster, extending from the knee on one side, with a space of two inches below the foot, around to the opposite side of the knee, and secured by adhesive straps around the leg, and a block inserted in the loop of plaster below the foot, to which a bandage is applied, as in

Physick's splint. The dressing is completed by tying the strips of bandage around the splints, and fastening by carpet-tacks.

How are extension and counter-extension accomplished by the double-inclined plane?—Extension is accomplished by the weight of the leg, and counter-extension by the weight of the body—acting upon opposite planes.

Fig. 169.



What are the objections to this apparatus?—It allows too great freedom of motion, and consequent risk of deformity.

What are the essential parts of Dr. Physick's modification of Desault's apparatus? (Fig. 169.)—It consists of three splints, one from the inner side of the thigh (extending from the perineum to the foot); one for the front of the thigh (extending the length of the thigh itself); and of a long splint for the outside of the thigh (extending from just below the axilla to beyond the foot), at the upper end of which is a hole morticed to receive the counter-extending band from the perineum, and having at its lower end a projecting block, over which is passed a handkerchief, fastened around the ankle and foot, and secured to the lower end of the splint, to accomplish extension.

What are the peculiarities of Hartshorne's splint?—It consists of a long external splint, extending from just below the armpit to beyond the foot; and a shorter splint for the inside of the thigh, padded at its upper end, where it comes in contact with the perineum; these are joined together at their lower extremity by a cross-piece, and extension is accomplished by means of a sliding foot-board regulated by a screw; while counter-extension is made by the short padded splint in the perineum.

What are the objections to both Physick's and Hartshorne's splint?—The pressure on the perineum, producing excoriations and sometimes sloughing.

What is the peculiar principle of Hagedorn's apparatus? —Counter-extension is kept up by the limb of the sound side, and the pelvis is confined so as to preclude all motion.

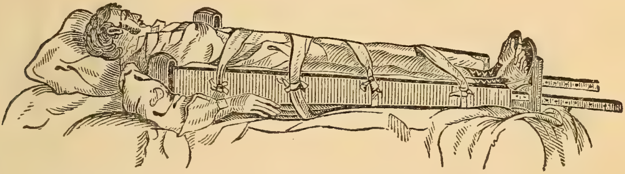
Of what does it consist as modified by Dr. Gibson? (Fig. 170.)—Of two long splints (one for each side of the body), extending from the axilla to beyond the foot; and of a foot-board, through which the lower end of both splints are passed, and which is placed at the proper distance by means of pegs passing through the splints.

How is it applied?—The limb is first adjusted by means of extension, counter-extension, and coaptation; the feet are secured by means of straps and gaiters to the foot-board, which is perforated for that purpose, paddings or cushions being interposed to take off the pressure; the foot-board is then fastened at the proper distance from

the extremity of the splints, bags of bran or tow placed so as to take off pressure; and the thighs firmly secured to the splints, and the splints to the body by rollers.

What is also advisable in most cases? — The application of light pasteboard splints, one in front and the other behind the fracture.

Fig. 170.



How should the patient be raised, so as to be enabled to pass his fæces, &c.?—He should be placed upon a sacking-bottom (stretched upon a frame), having a hole in the centre, by which means he may be raised without deranging the splints; or the apparatus of Jenks may be employed for the same purpose.

How may fracture of the patella be detected? — By the separation of the fragments, and inability of the patient to extend the leg.

How should it be treated? — The leg should be extended and elevated, and the fragments replaced and retained by a figure 8 bandage, and a long splint applied behind the limb, and secured by a roller.

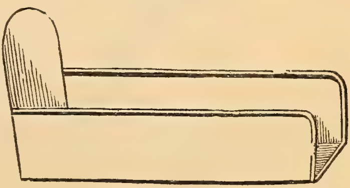
What treatment is necessary to prevent anchylosis? — After six or seven weeks, passive motion must be gradually employed.

How does fracture of the patella generally unite? — By means of ligamentous matter.

What is apt to occur after recovery from fracture of one of the patellæ?—Fracture of the opposite one.

How are the bones of the leg usually broken?—Fracture generally takes place in both bones, or in the fibula alone; without shortening if the fracture be transverse, with shortening if it be an oblique fracture, or with lateral deformity if the fibula alone be fractured.

Fig. 171.

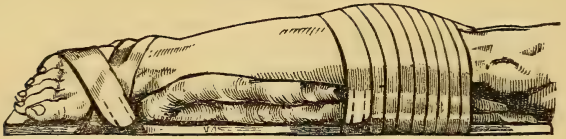


How is a transverse fracture of the bones of the leg to be treated? — The fractured extremities must be adjusted, and the limb, surrounded by a pillow, and placed in a fracture box (Fig. 171); or surrounded by a roller, or by the bandage of Scultetus, and placed upon a pillow, which is supported on each side by a long splint extending from the knee beyond the foot.

What apparatus is required in oblique fracture of the bones of the leg?—One which will overcome the shortening of the limb and retain it in its proper position.

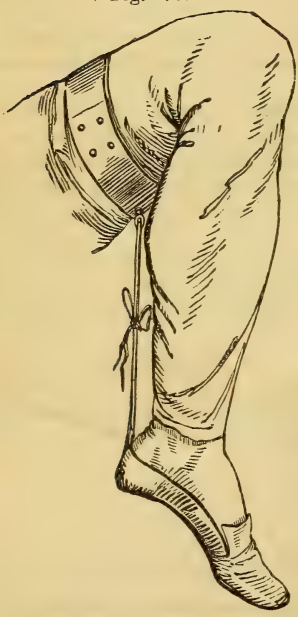
What is Hutchinson's apparatus?—It consists of two splints,

Fig. 172.



reaching from above the knee to below the foot; perforated at the top of each splint by four holes, and morticed at the bottom to receive a cross-bar, which connects the splints together.

Fig. 173.



How is it applied?—Two pieces of tape are secured on each side of the leg, just below the knee, by a few turns of a roller, leaving (on each side) four free extremities, which are passed through the holes in the upper part of the splints and tied; a handkerchief is then passed around the ankle and foot, and secured to the cross-bar.

How is fracture of the fibula with lateral deformity to be treated?—By the application (to the inner side of the leg) of a cushion or pad of a wedge-shape, four inches thick at its lower or thickest extremity, and extending from the knee to just above the ankle; over the cushion a long splint must be applied, which reaches beyond the foot; to these the leg must be secured by a roller, so that the foot may be drawn inward, in the space left below the pad or compress, and the lateral eversion of the foot thus overcome. (Fig. 172.)

How may fracture of the os calcis be detected?—By retraction of the detached fragment, and inability of the patient to walk.

How should it be treated?—The detached fragment should be drawn down, and retained in its proper situation by a bandage, and a splint applied upon the top of the leg, as in Boyér's bandage, or as in (Fig. 173.)

DISLOCATIONS.

What is a dislocation? — The displacement of the articulatory extremity of a bone from its natural situation.

What are the general symptoms? — Deformity in the part, alteration in the length of the limb, pain, and loss of motion.

With what other class of injuries are dislocations liable to be confounded? — With fractures extending into the joints.

What contributes to obscure the diagnosis? — The swelling which takes place shortly after the accident, owing to extravasated blood, or to inflammation.

What almost always takes place in dislocations? — Laceration of the ligaments or capsule.

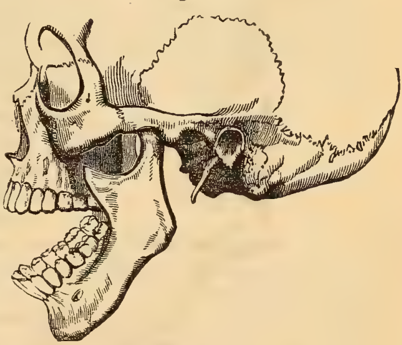
How are dislocations sometimes complicated? — With external injuries, fractures, with injuries of nerves and bloodvessels, with an external wound, and sometimes with agglutination of parts by effusion of lymph from inflammation.

What is the general treatment proper in dislocations? — Replacement of the bone, and the general antiphlogistic remedies to overcome inflammation.

How is the resistance of the muscles overcome? — By gradual extension; assisted, if necessary, by bleeding, warm bath, or nauseants, to produce relaxation, or by the inhalation of ether or chloroform.

How may dislocation of the jaw occur? (Fig. 174.) — It generally occurs from irregular muscular action; it may be of one or both condyles; and can only take place forward into the temporal fossa.

Fig. 174.



How is dislocation of a single condyle known? — When one condyle only is displaced, the jaws are partially opened; the chin twisted to one side, and immovable; a projection of the corresponding coronoid process under the cheek-bone, and a corresponding hollow in front of the ear.

What are the signs of luxation of both condyles? — The chin is drawn downwards and backwards; the mouth gapes; there is a projection of both the coronoid processes, and corresponding hollows in front of the ears; great pain, incapability of speaking, and dribbling of saliva from the mouth.

How is this dislocation to be treated? — The thumbs of the surgeon must be defended by being wrapped with cotton, or by gloves; they

are then introduced into the mouth, and the ramus of the jaw depressed by pressing upon the teeth; whilst the chin is lifted upwards and backwards by the fingers.

Do dislocations of the vertebræ ever occur? — They do; particularly of the cervical vertebra.

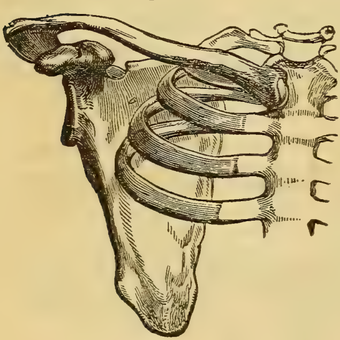
What is the prognosis? —Very unfavorable; the same effects being produced as in fractures of the vertebræ; and scarcely admitting any other than palliative treatment.

What are the ways in which dislocation of the ribs may take place? — The posterior extremity may be dislocated upon the body of the vertebra (this is very rare); the anterior extremity of the rib may be separated from its cartilage; or the cartilage may be separated from the sternum.

What treatment is to be adopted? — The patient must take a full inspiration to enlarge the diameter of the chest as much as possible; and the dislocation is then to be reduced by pressure with the fingers; and afterwards retained by compresses and a roller around the chest.

How may the clavicle be dislocated? (Fig. 175.) — The sternal extremity may be dislocated anteriorly, or behind the sternum; and the humeral extremity, above or below the acromion process.

Fig. 175.



How is dislocation of the sternal extremity of the clavicle to be treated? — It is to be reduced by drawing the shoulders backward (by which the clavicle is drawn off from the sternum, and falls into its natural position), and kept in this position by an apparatus on the principle of Desault's or Fox's.

What disagreeable effect has arisen from luxation of the sternal extremity backwards? — Inability to swallow, from pressure upon the œsophagus, sometimes requiring the bone to be cut through before it can be replaced.

How is the humeral extremity of the scapula generally dislocated? — Upon the acromion process.

How is it to be treated? — It must be reduced by placing the knee of the operator between the patient's scapulæ, and drawing his shoulders backwards and forwards, and afterwards supporting the arm in a sling.

Does complete recovery take place from this dislocation? — Patients rarely recover without some degree of deformity.

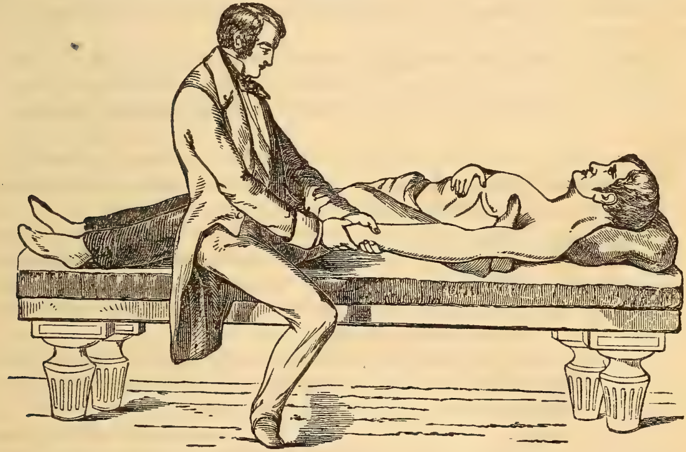
How may the os humeri be dislocated? — *Downwards*, into the

axilla; *forwards*, under the pectoral muscle; *backward*, on the dorsum scapulæ; and *partially*, the head of the bone resting against the external side of the coracoid process.

How may dislocation into the axilla be recognised? — By the shoulder losing its roundness, and becoming flat; by a hollow under the acromion process; by the lengthening of the limb; by the head of the bone in the axilla; by severe pain from pressure of the nerves; and by the inability to rotate the arm, or to lift it to the head.

How may this dislocation be reduced?—In relaxed persons, it may often be reduced as follows: the patient must be seated in a low chair; the surgeon then, resting his foot upon the chair, should place his knee in the axilla as a fulcrum, and depress the arm, taking care to press upon the acromion process as a point of counter-extension; or the patient should be placed on a sofa or table (Fig. 176), in a horizontal position, while the surgeon places himself opposite him; a ball of linen, or other soft material, is then placed in the axilla, upon which the surgeon places his heel, and, taking hold of the wrist or arm of the patient, makes traction, while the acromion process is fixed by an assistant, and the arm being gently drawn in.

Fig. 176.



If these methods fail, how is the dislocation to be treated? — Extension and counter-extension should be made, with the arm at right angles to the body, by means of a sheet folded diagonally, passed under the axilla (which should be defended by the ball, as in the former case), and held, or fastened to a post or staple; a towel is then fastened to the wrist, and traction made gradually and steadily by assistants, or by pulleys; taking care to keep the acromion fixed.

What is frequently necessary in reducing this luxation? — To relax the muscles by bleeding, or by the warm bath, and nauseants.

To what accident is the patient liable after the reduction? — To dislocation from very slight causes; the dislocation being, in these cases, easily reduced.

How do the symptoms differ in dislocation under the pectoral muscle? — The head of the bone is perceived under the muscle; the pain is not so great as in the former case, owing to the axillary nerves not being pressed upon; and the arm being readily moved backwards and forwards.

How is this dislocation to be reduced? — Convert it into a luxation into the axilla, and then reduce it in the same manner as in the former case.

What danger is to be apprehended when a considerable length of time has elapsed since dislocation? — If more than six weeks have elapsed, or if there has been considerable inflammation, greater danger will result in any attempt at reduction, from agglutination of the nerves and vessels near the joint.

How is dislocation upon the dorsum scapulæ recognised? — It is readily recognised by feeling the head of the bone, and by the motion of the arm being less confined than in either of the former dislocations.

How should reduction be attempted?—Convert it as in the former case; then reduce as in luxation into the axilla; or by extension and counter-extension, with the arm elevated above the head.

How is incomplete dislocation of the os humeri to be reduced? — In the same way as in the luxation into the axilla, except that it is also necessary to draw the shoulders backward; and afterwards to apply a bandage to keep the bone in its proper situation, and to prevent motion of the scapula forwards.

How may luxation take place at the elbow joint?—In five different ways: viz., the ulna and radius backwards; the ulna and radius laterally; the ulna alone backwards; the radius forwards; and the radius backwards.

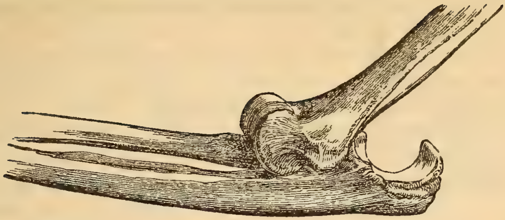
How is dislocation of the ulna and radius backward indicated? (Fig. 177.) — By a considerable projection posteriorly, above the natural situation of the olecranon, with a depression on each side, and a projection of the extremity of the os humeri anteriorly; together with inability to flex the joint, and a fixed supination of the forearm and hand.

How is reduction to be effected? — The surgeon should place his knee on the inner side of the elbow-joint of the patient, and press down the ulna and radius, while he gradually fixes the arm; or the arm may be bent around a bedpost, or over the back of a chair.

What after treatment is necessary?—The arm should be supported in the bent position by a bandage and sling.

How may lateral dislocation of the ulna and radius be known? —

Fig. 177.



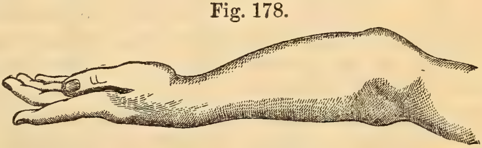
By the projection of the olecranon backwards, and by the lateral projection externally of the ulna, or of the external condyle, according as the luxation is external or internal.

How may luxation of the ulna backward be known? — By the projection posteriorly of the olecranon process, whilst the radius retains its natural situation; and by the twisting inwards of the fore-arm and hand.

How is reduction to be effected in these last two luxations? — In the same way as in the first species.

How may dislocation of the radius forwards be recognised? (Fig. 178.) — The fore-arm is a little bent, and cannot be completely extended, and any attempt at complete flexion is prevented by the head of the radius striking against the humerus.

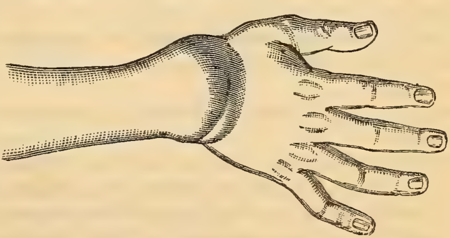
Fig. 178.



How should reduction be attempted? — By fixing the humerus and making traction upon the hand in a state of supination.

How may dislocation of the radius backward be recognised? — By the projection of the head of the radius behind, and to the outside of the external condyle of the humerus.

Fig. 179.



How should it be treated? — It should be reduced, as in dislocation of the ulna and radius, backwards, and afterwards the arm should be kept bent at right angles, and the bones in their proper position by means of bandages, for three or four weeks, until the torn ligaments have reunited.

In what ways do luxations take place at the wrist? (Fig. 179.) —

Either the radius or ulna, or both, are projected behind or before the carpus, with tension of the flexors and extension of the hand in the former case, and *vice versa.*

How are these luxations to be reduced? — By extension and counter-extension and pressure; afterwards, the bones should be kept in their proper position by splints and bandages.

What injuries are sometimes confounded with dislocation at the wrist? — Sprains and other injuries, followed by effusion.

How may they be distinguished? — By the swelling taking place gradually, and generally on one side, in the latter case; where, as in dislocations, the projection takes place immediately, and both anteriorly and posteriorly.

Fig. 180.

What characterises dislocation of the thumb? — Extreme difficulty of reduction.

How is reduction to be attempted? (Fig. 180.) — The thumb should be defended by a piece of buckskin, and extension made with it in a flexed position, by means of a tape fastened with a clove hitch; if this does not succeed, one of the lateral ligaments should be divided by a couching-needle.

How may the head of the femur be dislocated? — Upwards upon the dorsum of the ilium (Fig. 181); downwards into the foramen ovale (Fig. 182); backwards and upwards, into the ischiatic notch (Fig. 183, p. 326); and forwards and upwards, upon the body of the pubis (Fig. 184, p. 327).

With what other accident are dislocations of the femur frequently confounded? — With fracture of the head and neck of the bone.

How may they be distinguished? — By the crepitation which exists in the fracture, with the possibility of restoring the limb, by traction, to its natural length, and its immediately becoming shortened again, upon giving up traction.

How may the dislocation of the head of the femur upwards be recognised? — By the appearance of the head of the bone, and the trochanter major upon the dorsum ilii, with shortening and abduction of the injured limb, with little, if any, inclination of the knee and foot inwards.

How may dislocation downwards be recognised? — By the lengthening of the limb; the projection of the knee; the turning of the foot and knee outwards; and the bending of the body forwards, from the stretching of the iliacus internus and psoas muscles.

How may dislocation backwards and upwards into the sciatic notch be known? — By shortening of the limb, but not to the same extent as in dislocation upon the dorsum ilii; the inward inclination of the knee and foot; and the retraction of the heel.

How is the dislocation of the femur, upwards and forwards, detected? — By the shortening of the limb, the turning of the foot and

Fig. 181.

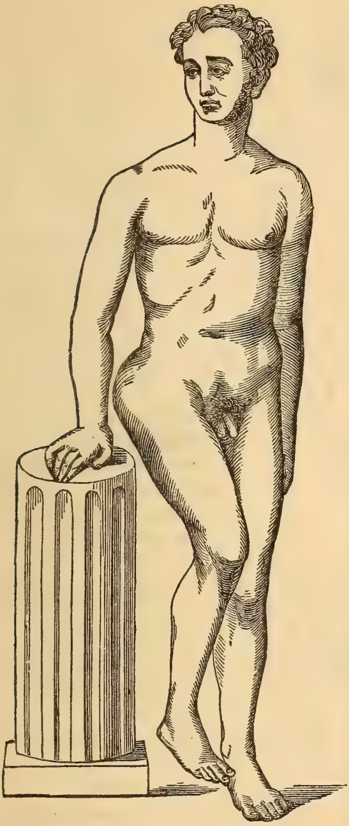
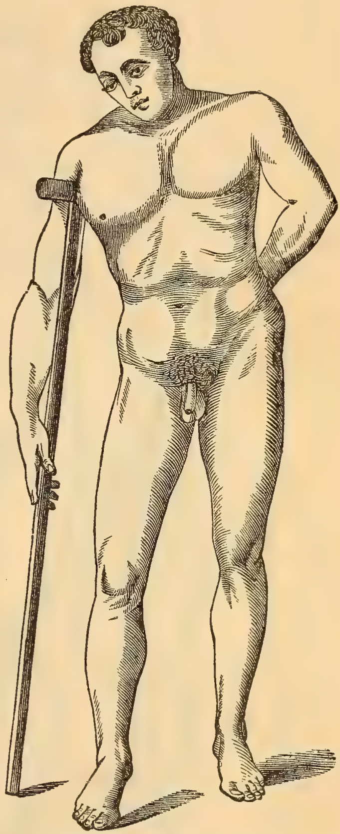


Fig. 182.

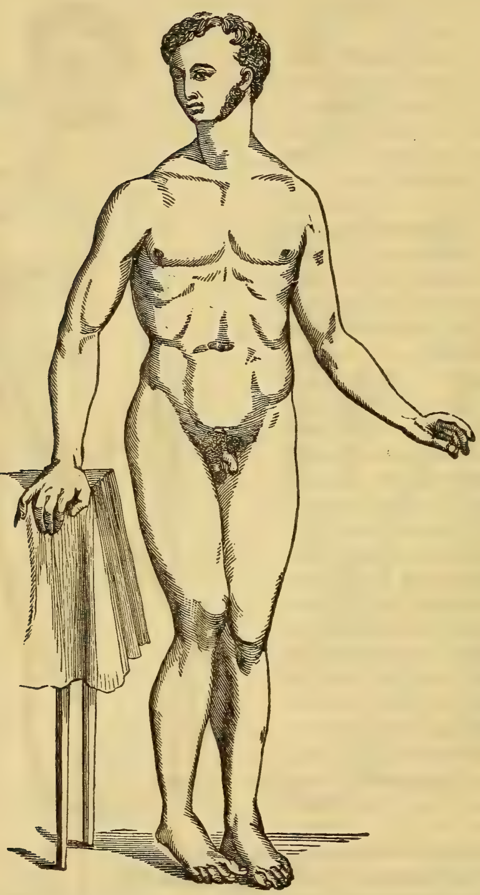


knee outwards, and the appearance of a round hard tumour formed by the head of the bone under Poupart's ligament.

How should luxations of the thigh be reduced? — The patient should be placed on a table upon his back (Fig. 185, p. 328); a sheet, folded diagonally, should then be placed in the perineum of the sound or injured side according to circumstances, and its ends tied to a post; another sheet is passed around the sound side of the pelvis, and its ends held by assistants; a padded belt with rings attached, should be buckled to the injured limb, just above or below the knee; to these

rings, one block of the pulley should be fixed, while the other is secured to a post, and the pulley-rope given in charge to assistants;

Fig. 183.

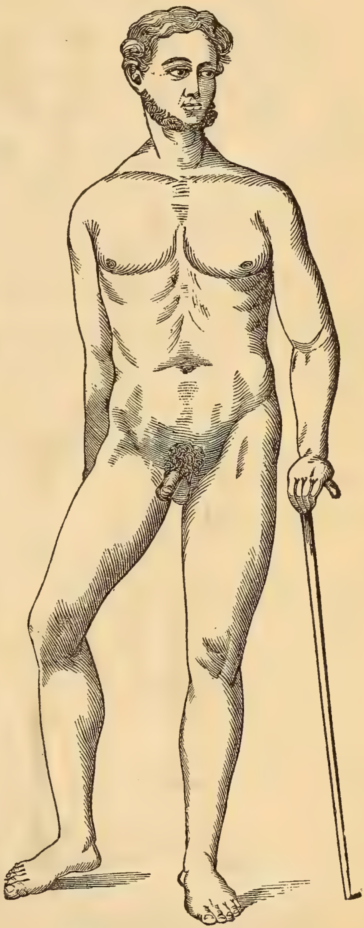


the surgeon, then, standing at the injured side, directs gradual extensions to be made in the proper direction, while he himself by his hands, or by a band passing around the injured thigh and over his own shoulders, lifts up the head of the bone and guides it into its socket.

What plan has Dr. Reid, of Rochester, suggested for reduction of the dislocation (by manipulation alone) of the femur upwards and

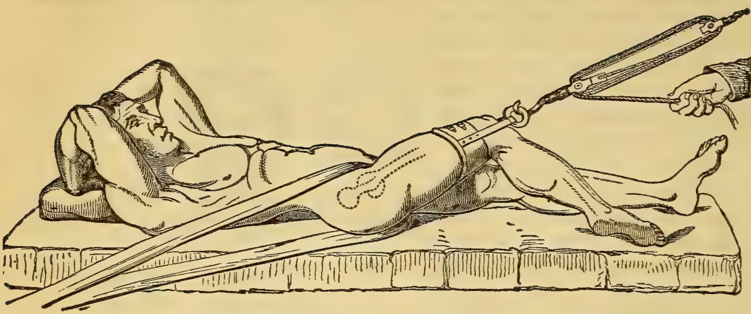
backwards on the dorsum ilii, and the other forms? — The patient is placed upon a low, firm table. The operator stands next the injured side, and seizes the ankle with one hand, and the knee with the other. He then flexes the leg on the thigh, and strongly abducts it, carrying it over the sound one and upwards over the pelvis, with a sweep as high as the umbilicus. He then gently *abducts* the knee, turning the toes outwards, and the foot across the sound limb, making gentle oscillations of the thigh, when the head of the bone will be heard to slip into its place. When upwards and forwards, the same relative position of surgeon and patient is observed. The limb is strongly abducted in the right position, and the foot rotated more strongly outward, when it will slip into the thyroid foramen. The thigh should then be strongly flexed on the pelvis, and carried across its fellow, when, by rotating the leg outwards, bringing the sole of the foot so that it looks outwards and upwards, the head of the bone makes a semicircle backwards, and slips over the edge of the acetabulum. In luxations in the thyroid foramen, or downwards, the thigh must be flexed on the pelvis, carrying it across its fellow, and inducing circumduction When luxation backwards and upwards, or in the sciatic notch, takes place, flex the thigh upon the pelvis, and carry it across its fellow, and slowly abduct it from the body, similar to that for luxation upon the dorsum ilii.

Fig. 184.



What delay is sometimes necessary in reducing a luxation in the ordinary manner? — It is sometimes necessary to keep up extension

Fig. 185.



and counter-extension for two or three hours before the reduction can be accomplished.

How may the patella be dislocated?—In three directions; upwards (from rupture of its ligament), outwards, inwards, and on itself.

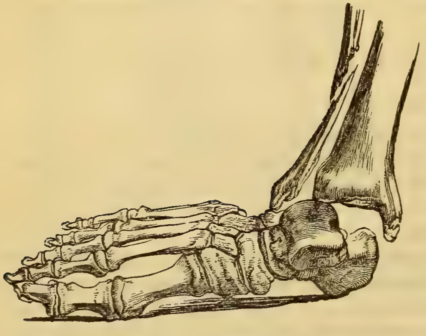
How is dislocation of the patella to be treated? — The leg and thigh must be elevated so as to relax the muscles, and the patella restored to its proper situation, and secured by a bandage or laced knee-cap, or adhesive straps, and a splint on the back of the leg.

What dislocations may occur at the knee-joint? — Displacement of the semilunar cartilages, and luxation of the tibia forwards or backwards.

How are displacements of the semilunar cartilages to be treated?—The foot must be turned outwards, and the leg flexed to relax the ligaments, and then the cartilages replaced and retained by a bandage or laced knee-cap.

What treatment is proper in dislocations of the tibia from the condyles of the femur? — If the luxation be incomplete, it is easily reducible by extension, counter-extension, and pressure; but if it be complete, the injury to the surrounding parts is so great as to call for severe antiphlogistic treatment, and, sometimes, even for amputation.

Fig. 186.



How are dislocations of the tibia and fibula from the astragalus (Fig. 186) to be treated?—In simple dislocations, the muscles should be relaxed by flexing the leg upon the thigh; extension is

then to be made by the foot, and counter-extension by the thigh; and the dislocated bones pressed into their proper places, and retained by splints and bandages until the ligaments have reunited.

What is necessary in luxations of the astragalus? — Force the bone back judiciously into its place, if possible, and then enjoin rest and antiphlogistic measures. This is a difficult luxation to reduce, and it may be necessary to excise the bone or amputate the foot.

SPRAINS.

What is a sprain? — An injury, accompanied with stretching and more or less laceration of the ligaments of the joint, and sometimes with rupture of the tendon.

What are the symptoms produced by sprains? — Violent pain, and deformity; and discolouration from extravasated blood in the joint.

How should this accident be treated? — The limb should be immediately elevated, and kept in a state of absolute rest by a splint.

What is indicated in treatment?—If seen early cold water dressings are advantageous; if not, leeching should be used, and warm water dressings, or poultices. Stimulating liniments are hurtful in the early stage, and puncturing, to evacuate extravasated blood, is productive of no good, and often injurious.

When may cold or warm douches or stimulating frictions be resorted to? — After inflammation has entirely subsided, they are useful to remove the stiffness of the joint.

RUPTURES OF TENDONS.

How is the rupture of a tendon indicated? — A sudden snap is heard, followed by pain, loss of motion in the part, and swelling and discolouration.

How should this accident be treated?—The parts should be placed in such a position as to relax the tendon, the ends of which should be brought together and retained in contact until union has taken place.

DISEASES OF THE BONES AND JOINTS.

PERIOSTITIS AND OSTEITIS.

What is meant by periostitis, and what are its symptoms? — Inflammation of the periosteum, which may result from injuries or syphilitic taint, or from disease of the subjacent bone. Its symptoms are a hard, but puffy swelling, not distinctly circumscribed, and attended with pain, especially at night.

What is the treatment for it? — In the acute form the free application of leeches, hot fomentations, with calomel and opium internally. In chronic cases the free use of hydriodate of potash or cod-liver oil internally, and externally leeching, blistering, and painting with tincture of iodine, &c.

What is meant by osteititis, and what are its causes? — Inflammation of the bone itself. It may arise from constitutional taint or local injury.

What are its symptoms and treatment? — The bone is enlarged, with deep-seated pain, and tenderness of the limb; the pain is increased at night. Its treatment is similar to that of periostitis.

CARIES.

What is caries? — An ulceration of the bone from violence or inflammation, or from constitutional disease.

What bones are most liable to this disease? — The spongy bones.

What are the indications of treatment? — To keep the part in a state of absolute rest by means of splints, to subdue the inflammatory symptoms, and to make use of appropriate constitutional remedies, where the disease arises from scrofula or syphilis. Touching the diseased bone with the mineral acids, or the gastric juice of the hog, or with lunar caustic, will facilitate the removal of the diseased parts.

NECROSIS.

What is necrosis? — The complete death of a bone, from injuries and inflammation of the periosteum.

Fig. 187.

What bones are most liable to necrosis? — The shafts of the long bones (Fig. 187), and next to these the flat bones; the tibia is the bone most frequently attacked.

How is necrosis indicated?—By dull, deep-seated, but sometimes acute pain, followed by increase in size of the bone, from the formation of new bones surrounding the old one (or sequestrum), which is gradually broken down and discharged through openings externally.

In what way is the new bone formed?—By secretion from the periosteum.

What treatment is proper? — No treatment is of any advantage, excepting a poultice, or anodyne fomentation over the part, unless the tedious discharge of the sequestrum gives rise to much constitutional irritation; in which case an opening should be made in the new bone by means of a trephine, or otherwise, and the sequestrum removed.

EXOSTOSIS.

What is exostosis? — An unnatural growth of bone, without malignant disease.

What forms does exostosis assume? — Either a spinous, a lamellar, a tuberculated, or a circumscribed form.

What inconveniences result from exostosis?—Deformities, and interference with the motion of the neighbouring joints.

What treatment is proper for the cure of exostosis? — Abstinence, local pressure, leeching, and blistering, or the application of iodine, will sometimes prove efficient, if the tumour be not very large; but if the tumour be of great size, or inconvenient from its situation, it must be removed by the knife or the saw.

SPINA VENTOSA.

What is spina ventosa? — A bony tumour, in which the interior of the bone is removed by ulceration, leaving merely a shell of bone secreted by the periosteum, divided into cells containing purulent matter.

What bones are the seat of the disease? — Generally the long or cylindrical bones.

How is spina ventosa to be treated?—Stimulant injections into the cavity sometimes succeed, and pressure, but if the tumour be large, its removal is the only remedy.

Fig. 188.

OSTEO-SARCOMA.

What is osteo-sarcoma? (Fig. 188.) — A malignant tumour, or diseased growth of bone, in which its substance is changed into a mixture of bony and fleshy matter.

What are its symptoms? — A dull, long-continued and deep-seated pain, accompanied with, or followed by, the appearance of a ponderous tumour upon the bone, sometimes smooth, but oftener irregular, and tuberculated; which sometimes gives rise to ulcerations through the skin, and the discharge of a fetid, sanious, or cheesy matter.

What bones are attacked by this disease? — It generally attacks the long bones, but frequently, also, the bones of the upper and lower jaw.

What is to be done in this disease?—In its early stages, alteratives, and general and local applications may be tried; but in general nothing less than its removal by the knife will be sufficient.

MORBUS COXARIUS, OR COXALGIA.

What is meant by morbus coxarius, or coxalgia? (Fig. 189.)—Inflammation of the hip-joint, terminating, if not arrested, in ulceration and destruction of the head and neck of the thigh bone.

Fig. 189.

In what class of persons does this disease most frequently occur?—In persons of a scrofulous diathesis or constitution.

What are its symptoms?—Pain in the knee, tenderness on pressure upon the hip-joint, wasting of the limb, the patient standing and walking with the leg and thigh flexed; and after separation of the head of the bone from its shaft has taken place, shortening of the limb, from the retraction of the muscles.

What plan of treatment is to be pursued in this disease?—If the disease be detected before suppuration has taken place, leeches or blisters should be applied, or issues established in the neighbourhood of the joint, and perfect rest enjoined; but if the disease has gone on to suppuration, the patient should be kept upon his back, on a mattress, and a splint carved or moulded to fit the limb in its bent position, and padded, should be applied; a tonic regimen should be adopted, and the patient purged daily, or every other day, with the pulvis purgans (a combination of jalap and bitartrate of potassa), unless he should be debilitated by the purging.

What is necessary after the splint has been worn for some time?—To remove the splint, and substitute a straighter one, owing to the straightening of the limb from the use of the splint.

How long does this disease require for its cure?—From six to eighteen months

WHITE SWELLING AND SYNOVIAL DEGENERATIONS.

What is meant by the term white swelling?—It is a generic term, used to denote any disease of the joint accompanied with swelling and white colour, from tension of the integuments.

How are these diseases divided?—Into hydrarthrosis, or inflammation of the synovial membrane, with dropsical or serous effusion; morbid change of structure of the synovial membrane; ulceration of the cartilages of the joint; and scrofulous disease of the cancellated structure of the bones.

How is the inflammation of the synovial membrane known?—By pain (generally not severe); and after effusion has taken place, by swelling and fluctuation.

How does this disease sometimes terminate? — In anchylosis, from effusion of lymph into the joint.

How should it be treated?—By rest and elevation of the limb, and by general and local antiphlogistic means.

Should the fluid ever be evacuated by tapping? — It should not, for fear of the violent inflammation which frequently follows wounds of joints.

What are the symptoms of morbid change of structure of the synovial membrane? — Pain, or sensation of uneasiness, stiffness, swelling, a deceptive sense of fluctuation, and sometimes the formation of abscesses, which weaken and exhaust the patient.

What is the remedy? — Amputation is generally the only hope.

How may ulceration of the cartilages be known? — It is very difficult to be distinguished from inflammation of the synovial membrane, (of which it may be considered one of the terminations), except that in the ulceration of the cartilages, there is no swelling early in the disease.

How is the disease to be treated? — By rest, splints, blisters, issues, &c.

How does it generally terminate? — In anchylosis.

How may scrofulous affections of the knee-joint be recognised? — By pain in the head of the tibia, and swelling of the knee-joint, at first without discolouration, followed, as the disease advances, by emaciation of the limb, swelling and tension of the integuments of the knee, which are white and shining, and covered with varicose veins; thickening of the synovial membrane; and sometimes the discharge of matter from ulcerated openings in the joint.

What is the proper treatment? — Rest, splints, iodine, and the same general treatment as in morbus coxarius.

ANCHYLOSIS.

What is anchylosis? — The loss of motion in a joint.

How many kinds of anchylosis are there? — Two; *complete*, where the bones of a joint are united together, or so changed by deposition of fresh matter as to be immovable; and *incomplete*, where some motion still remains, and the rigidity is owing to the stiffening of ligaments, or the contraction of tendons, &c.

What treatment is often successful in incomplete anchylosis? — Passive motion imparted to the joint; and stimulating liniments, and friction.

How may complete anchylosis be remedied? — Complete anchylosis cannot be cured, but may sometimes be remedied by cutting through the bone near the joint, and preventing the union of the cut ends; thus forming an artificial joint, as in Dr. J. Rhea Barton's operation,

MOVABLE CARTILAGE.

What are movable cartilages? — Small cartilaginous bodies floating in the joint, loose, or attached to a pedicle; and giving rise to severe pain, and interference with the motions of the joint, by being caught between the condyles of the femur and the head of the tibia.

How should they be treated? — The knee should be bandaged tightly, or covered with a laced knee-cap, to prevent the escape of these bodies; and if this proves unsuccessful, they must be extracted by excision.

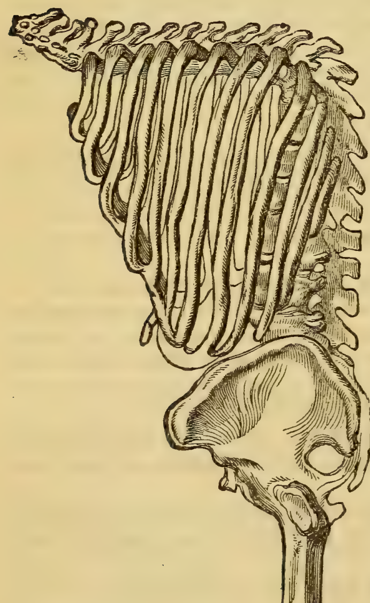
What cautions are necessary in this operation? — The movable cartilage should first be secured at the upper and outer part of the knee, and an incision made barely large enough to admit of the extraction of the cartilage; taking care that the incision in the skin does not correspond with that in the synovial membrane.

What after measures are to be adopted? — Opiates, and elevation of the limb, and other means to prevent inflammation of the joint.

RACHIALGIA, CARIES OF THE SPINE, OR DISEASE OF POTT.

What is the disease termed caries of the spine? (Fig. 190.) — A destruction, by caries, of the bodies and cartilages of the spine.

Fig. 190.



What are its symptoms? — A sense of weakness and numbness in the lower extremities; a tendency to stumble; retraction and crossing of the legs, when the patient is seated; tenderness on pressure upon the part of the spine affected; distortion of the spine from loss of substance; loss of motion in lower extremities; and symptoms of general gastric derangement; with flatulence, and sense of tightness in the præcordial region.

With what other disease is caries of the spine often confounded? — With distortion of the spine from contraction of the muscles.

How should spinal caries be treated? — The weight of the head should be taken off the spine by a machine contrived to support it; or the patient should be kept upon his back on a mattress, upon which he should be carried frequently into the open air; setons or

caustic issues should be made on each side of the spine, at the affected part; and the bowels kept open by rhubarb, or by the pulvis purgans, as in morbus coxarius.

HYDRO-RACHITIS, OR SPINA BIFIDA.

What is spina bifida? — A congenital, and frequently fatal disease, consisting of a deficiency of a part of the spinal column, and a projection at that part of the membranes of the spinal marrow, in the form of a tumour filled with serum; and is generally accompanied by loss of motion in the lower extremities.

What effect is sometimes produced by pressure upon the tumour? — Symptoms resembling those of compression of the brain.

How should this disease be treated?—It should be punctured with a needle, and the fluid evacuated, a little at a time, and at intervals of several days.

What effects have followed the sudden evacuation of the fluid? — Convulsions, and speedy death.

FRAGILITAS OSSIUM.

From what does fragility of the bones arise? — From deficiency of *animal*, and a predominance of *earthy* matter in the bone.

In whom does it occur, and what treatment is proper? — Generally in aged persons, or in syphilitic cases of long standing; in the former case, all treatment is nugatory; in the latter, constitutional remedies may perhaps do good, especially cod oil.

MOLLITIES OSSIUM, AND RACHITIS.

What is mollities ossium? — A softening of the bone, from deficiency of the earthy matter, taking place in persons advanced in life.

How does rachitis or rickets differ from mollities?—Rickets attacks children and infants; and the bones, after a time, generally acquire their proper strength.

How should these complaints be treated? — In mollities no treatment will generally avail, though the phosphate of lime and cod oil have been used; in rachitis, tonic medicines, generous diet, gentle purging, frictions, and salt bathing will frequently accomplish a cure.

DISEASES OF THE BLOOD-VESSELS.

How may the arteries become diseased? — From inflammation, from deposition of bony or calcareous matter between their coats, and from dilatation, or aneurism.

Do arteries ever ulcerate? — Rarely, except in case of calcareous degeneration of their coats, or sometimes from the application of the ligature.

Are veins liable to inflammation? — Yes; much more so than arteries.

From what does phlebitis, or inflammation of the veins arise? — From the application of ligatures, or sometimes from wounds, as in the operation of bleeding.

What are the symptoms of phlebitis? — Pain and tenderness on pressure; an indurated knotted condition of the vein, with occasionally a red streak of inflammation over its course; sometimes terminating in secretion of pus, which finds its way into the circulation, producing great prostration, a quick, fluttering pulse, nausea, tympanitis, and tenderness of the abdomen, delirium and death.

How may a spontaneous cure of phlebitis take place? — By obliteration of the vein from effusion of coagulable lymph.

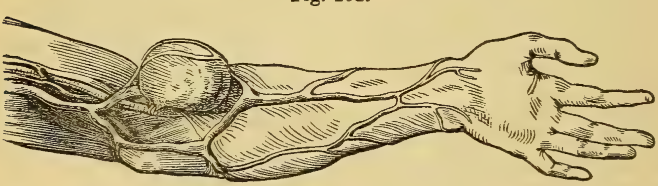
How should phlebitis be treated?—By the elevation of the affected part, so as to favour the return of the blood; by leeching and blisters, or pressure upon the affected part; or by compression above the point of inflammation, and by antiphlogistics generally.

ANEURISM OF THE ARTERIES, AND THE NECESSARY OPERATIONS

What is aneurism? — A tumour filled with blood, and communicating with the cavity of an artery or vein.

How do aneurisms of the arteries usually occur? — From dilatation of all the coats of an artery, or from rupture of the internal coats and dilatation of the cellular, in which cases it is denominated true *aneurism;* or from puncture of the arteries, with extravasation of blood into the surrounding tissue, when it is called *false aneurism* (Fig. 191); the sac in the former case being formed by the coats of the artery, and in the latter by the cellular tissue.

Fig. 191.



What arteries are not subject to aneurism? — The arteries of the brain, from their being destitute of a cellular coat.

What general remedies are used in the treatment of aneurism? — The long-continued application of cold, or pressure, by means of Bellingham's compressor (Figs. 192, 193); and the diminution of the force of the circulation by abstinence, blood-letting, digitalis, and absolute rest.

Are these means always successful? — They very frequently fail, and an operation becomes necessary.

What operation was formerly practised? — The application of a

Fig. 192.

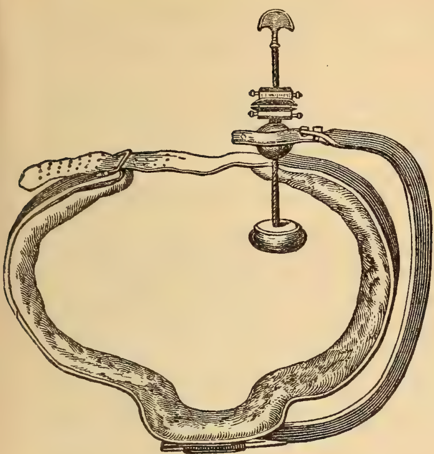
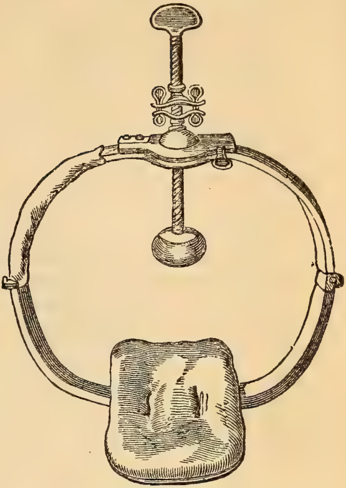


Fig. 193.



ligature to the artery just above the aneurism, and afterwards evacuating the sac.

Why was this abandoned? — On account of its frequent failure, owing to the diseased state of the artery in the neighbourhood of the aneurism, and the irritation excited by opening and evacuating the sac.

Fig. 194.

Fig. 195.

Fig. 196.

What operation is now employed? (Figs. 194, 195, 196.) — That of Hunter, viz.: tying the artery, in a sound part of it, at some distance from the sac, and between it and the heart (thus taking off the force of the circulation from the aneurism).

What other operations have been subsequently proposed? — Those of Bradsor and Wadrop: the first consists in tying the artery below the sac, with the view of bringing about co-

agulation in it; the latter by tying the artery below its first bifurcation.

What success has attended the last two operations? — They have almost uniformly increased the size of the aneurism, or failed to produce any good effect.

What cautions are necessary in operating for aneurism? — The artery should be cut down to and separated from its connections to as small an extent as possible, and the ligature thrown around it by means of a crooked needle and Pysick's forceps, or the common curved aneurismal needle, or by Gibson's modification of Bellocque's instrument.

What are the signs of aneurism of the thoracic aorta? — Violent neuralgic pain, palpitation, dyspnœa, cough, and sense of constriction of the chest; unnatural flatness on percussion of the upper part of the chest; loud, rough, and abrupt bellows' murmur above the clavicles upon auscultation; loss of power or numbness of one arm, and weakness or total absence of pulsation at the corresponding wrist; with frequently sibilant respiration, croaking voice, difficulty of deglutition, and œdema, or dropsy of the serous cavities, from compression of the trachea, œsophagus, or blood-vessels; and sometimes absorption of the ribs from pressure.

What peculiar form of aneurism sometimes occurs in the thoracic aorta? — Dissecting aneurism, in which the blood gradually finds its way between the coats of the artery, and separates them for a considerable distance.

How may aneurism of the abdominal aorta be known? — By the appearance of a pulsatory tumour in the abdomen, readily detected by pressure, and frequently giving rise to œdema or dropsy of the abdomen and lower extremities, and sometimes to absorption of the bodies of the vertebræ, and to consequent paralysis of the lower limbs.

What treatment is suitable to aneurism of the thoracic and abdominal aorta?—An operation is inadmissible, but relief has been occasionally afforded by bleeding, abstinence, digitalis, and the external application of cold and pressure; although the disease most frequently terminates in ulceration and fatal hemorrhage.

How may aneurism of the carotid be known from any other tumour? — By the aneurismal tumour becoming less by pressure upon the artery below it, and by our not being able to lift the tumour from the artery.

Describe the operation for carotid aneurism. — The patient should be placed in a recumbent position, with the head thrown back and the face to the sound side; an incision from two to four inches long should then be made at the inner edge of the sterno-cleido-mastoideus muscle, below the tumour, having the middle of the incision, if possible, over the omo-hyoid where it crosses the sheath of the vessels; this incision should cut through the skin, platysma myoides, and fascia superficialis colli; the head should now be bent in such a way as to

relax the sterno-cleido-mastoideus, and the cellular tissue, and afterwards the fascia profunda should be raised up by a pair of forceps, and divided; the omo-hyoid and descendens noni are to be carefully avoided, and the sheath of the vessels pinched up with a pair of forceps, and divided for about half an inch; the par vagum and internal jugular are to be held aside, and a ligature passed gently under and around the artery, which is then to be lifted slightly and compressed, and if pulsation ceases in the tumour, the ligature is to be tied, one end cut off, and the other left hanging out of the wound, which is then brought together by adhesive straps. (Fig. 198.)

Fig. 197

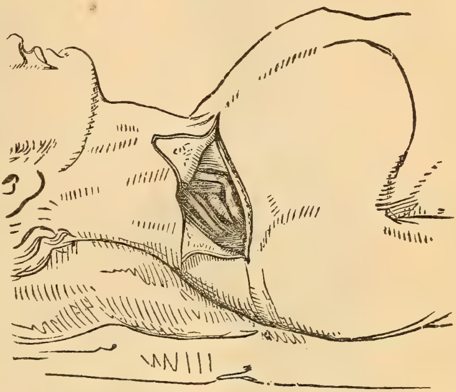
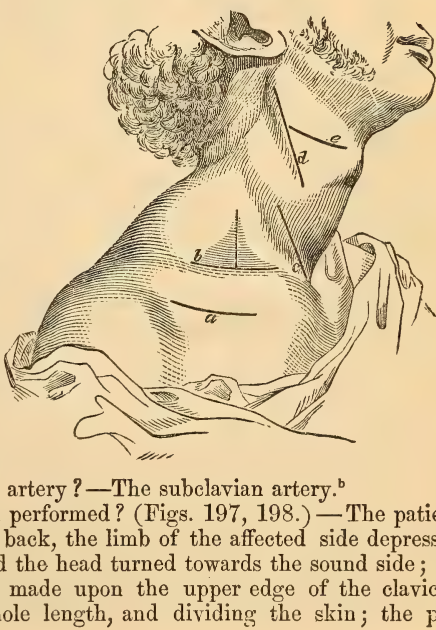


Fig. 198.



At what time does the ligature come away?—Generally at the end of the fifteenth day.

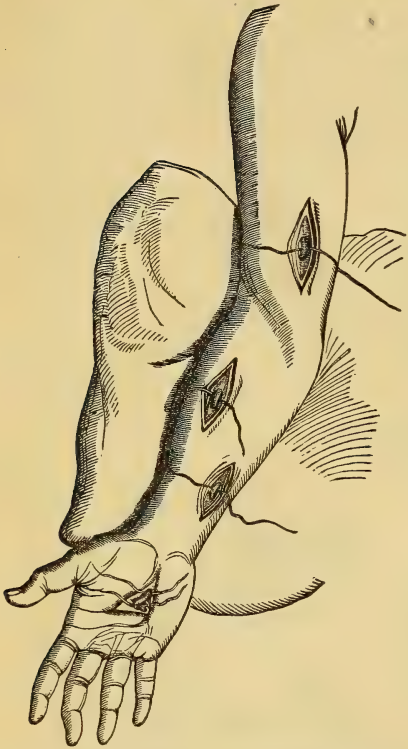
Why should not two ligatures be applied, and the artery divided between them?—They are unnecessary, and accompanied with considerable risk of ulceration and secondary hemorrhage.

What vessel is tied in the operation for aneurism of the axillary artery?—The subclavian artery.[b]

How is this operation performed? (Figs. 197, 198.)—The patient should be placed on his back, the limb of the affected side depressed as much as possible, and the head turned towards the sound side; an incision should then be made upon the upper edge of the clavicle, extending nearly its whole length, and dividing the skin; the pla-

tysma myoides, superficial fascia, and cellular tissue are next to be carefully divided; the external jugular is then held aside by a blunt hook or a curved spatula, while a ligature is passed around the artery and tied; taking care first to ascertain that we have not mistaken one of the brachial plexuses of nerves for the brachial artery.

Fig. 199.



What artery is to be tied in brachial aneurism?—The brachial or humeral artery.

How is this accomplished? (Fig. 199.)—A tourniquet is applied by some operators to render the superficial veins visible, and prevent their being wounded; an incision through the skin is then made at the inner edge of the biceps muscles, at about the middle of the arm; the fascia is next divided, and then the sheath of the vessel is opened and the vessel tied.

What sometimes occurs after this operation?—It frequently is not followed by success, and the artery must be tied above and below the sac before a cure can be effected.

How may inguinal aneurism be known from inguinal hernia?—By the tumour in the former case being irreducible; by its pulsation, and by its gradual increase; with numbness, and obstruction of circulation in the limb.

What vessel must be tied for the cure of inguinal aneurism?—The external iliac artery.

How is this performed? (Fig. 200.)—An incision, about six inches in length, should be made through the skin and superficial fascia of the abdomen, over the course of the external iliac artery as it lies under Poupart's ligament, commencing an inch and a half from the anterior superior spine of the ilium, and extending to within half an inch of Poupart's ligament; the fibres of the external oblique, and of the lower edge of the transversalis are then separated, with as little cutting as possible, raising them carefully by the forceps or by the

Fig. 200.

finger passed behind them, to prevent wounding the peritoneum, the fascia transversalis should then be pinched up, and divided in the course of the spermatic cord; the finger may then be passed behind the peritoneum to the external iliac artery and vein at the edge of the psoas muscle, and the vein may be held aside by a curved spatula or blunt hook, or by the finger, while a ligature is passed around the artery by an aneurismal needle.

What vessel must be tied in gluteal aneurism? — The internal iliac artery, which may be reached in the same way as the external.

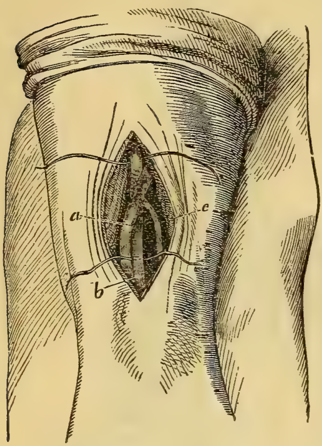
What vessel must be tied in aneurism of the internal or external iliac arteries?—The common or primitive iliac, which may be reached in the same way as the iliac arteries.

How may popliteal aneurism be recognised? — By the appearance of a pulsating tumour in the ham or back part of the knee-joint, producing numbness, obstruction of circulation, and sometimes œdema of the leg.

What operation is required for the cure of this aneurism? (Fig. 201.)—Pressure or ligature of the femoral artery; or, if the popliteal has been directly injured, by placing the patient on his face, and a free incision made, traversing the popliteal space, and penetrating

the skin and subjacent tissues, and continued cautiously along the borders of the semitendinosus and membranosus muscles. On the edge of the latter muscle the artery may be felt, sometimes overlapped by it. The nerves and vein should be carefully avoided, and a ligature thrown around at the upper part of its course.

Fig. 201.



How should ligature of the femoral be accomplished? — An incision about three inches long should be made along the inner edge of the Sartorius muscle, commencing about four inches below Poupart's ligament; the skin and fascia being divided, the Sartorius is held to one side, and the sheath of the vessel pinched up and opened, and a ligature passed around the artery, carefully avoiding the vein.

What plan would you pursue in ligaturing the tibial arteries? (Figs. 202, 203.)—In operating upon the posterior tibial, the limb is placed on its outer side, a free incision is made between the edge of the tibia and gastrocnemius, dividing the tibial origin of the solæus, the deep fascia is cut, and the artery is found an inch from the tibia. The veins and nerve should be carefully watched, and the incision held open with a spatula; the knee being bent and foot extended, the needle is passed from without inwards. The operation at the lower part of the leg and ankle is much more simple. The anterior tibial may be tied either at the upper or lower part of the leg. At the upper, by a free incision between the extensor communis digitorum and tibialis anticus, the foot is flexed, and the relaxed muscles are separated down to the interosseous ligament, where the artery is found. At the lower part, the incision is made on the fibular side of the extensor proprius pollicis.

What is aneurism by anastomosis? — An erectile or highly vascular tumour formed by a congeries of varicose or enlarged vessels, and frequently communicating a thrilling or pulsatory sensation to the fingers.

How should these be treated? — They should be strangulated, by means of ligatures crossing each other, and thus dividing the tumour into portions, the ligatures being tied separately: and also by dissecting the tumour out.

What is varicose aneurism? — A tumour arising from a communication between an artery and a vein.

What are its varieties? — *Direct* varicose aneurism, where the artery and vein are in direct contact; and *indirect*, where they are

separate, and communicate through a sac formed in the surrounding cellular tissue.

How does this form of aneurism occur?—It generally occurs at

Fig. 202.

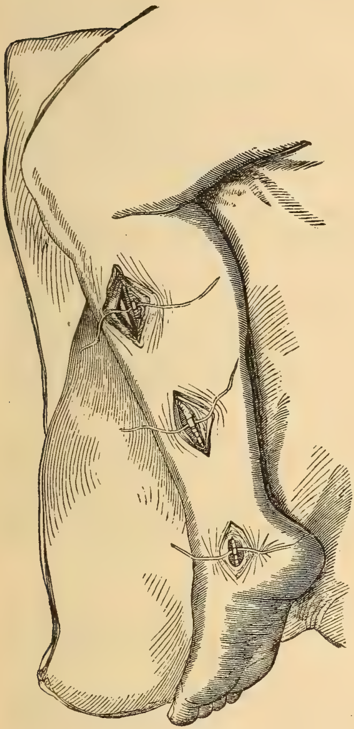
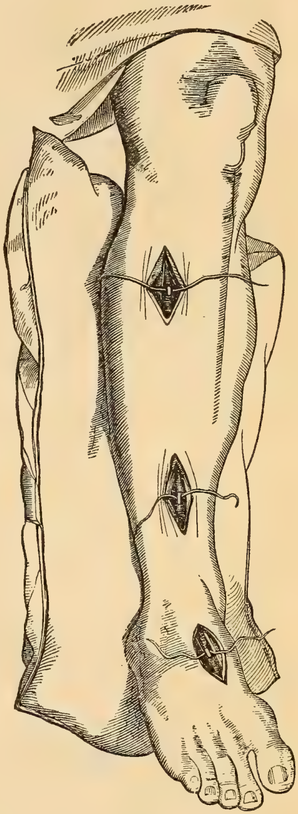


Fig. 203.



the bend of the arm, from a lancet being pushed through the vein into the artery, in bleeding.

How is it known?—By the appearance of a tumour, communicating a thrilling sensation, and generally accompanied by an enlarged and tortuous condition of the vessels above the tumour.

What effect has pressure?—It tends to produce the indirect form, or to aggravate it when it already exists.

What operation is generally performed?—Tying the brachial artery immediately above and below the sac.

To what enlargements are the veins subject? — To a varicose, or enlarged tortuous condition, sometimes producing ulceration, or sloughing of the integuments from their pressure.

What veins are most liable to this disease? — The veins of the leg; from the weight and pressure of blood upon them.

What method of treatment was formerly tried? — Ligature of the vein above; but this was abandoned, from its tendency to aggravate the disease, or produce phlebitis.

What methods are now adopted?—Elevation of the limb; equable compression by laced bandages, or rollers; and, in extensive cases, the passage of a curved needle beneath, or through the coats of the vein; and then surrounding the needle by a ligature in the form of a figure 8, in order to produce obliteration of the cavity of the vein; drawing off the blood, and bandaging.

What other varieties of this disease are there? — Varicocele, or enlargement of the veins of the scrotum; and circocele, or enlargement of the veins of the spermatic cord.

How may these varieties be distinguished from scrotal hernia? — By the tumour in varicocele and circocele commencing at the lower part of the scrotum and travelling up; by the enlarged and tortuous feel of the veins; and by the tumour retiring when the patient is on his back, and returning when he rises, or when pressure is made upon the cord at the external inguinal ring.

What modes of treatment are pursued? — The elevation and support of the scrotum, by a suspensory or bag truss; or the excision of a part of the scrotum; or passing the scrotum through a metallic ring, and then pressing the sides of the ring together, and by passing needles behind the veins, and fastening a ligature around them.

DISEASES OF THE NERVES.

What is neuritis?—Inflammation of the neurilemma, and substance of the nerve.

What is neuralgia? — Severe lancinating, or shooting pain, in the course of a nerve; sometimes accompanied with heat and swelling, from neuritis, or inflammation of the nerve.

From what causes does it originate?—From constitutional, or from mechanical causes; as, in the latter case, a ligature upon a nerve by mistake, irritation from a spiculum of bone, or other foreign body.

What surgical treatment is sometimes requisite? — Removal of the foreign body; or division of the nerve, or excision of a part of it.

What particular form of neuralgia sometimes attacks the testicle?— Irritable testis.

What are its symptoms? — Tenderness on pressure, pain in the back, and in the groin and thigh of the affected side; and only relieved by rest in the recumbent position upon the sound side.

What treatment should be pursued?—The usual antiphlogistics; anodynes given internally, or the application of emplastrum belladonnæ may be tried; but the only certain remedy is the division of the external spermatic nerve.

What is neuroma, or painful tubercle?—A circumscribed tumour, generally extremely painful, in the substance of a nerve.

What remedy is to be employed?—Extirpation, or removal by the knife.

What is tetanus?—Violent spasmodic contraction of the muscles, from wounds, irritations of nerves, or from constitutional causes.

How is tetanus divided?—Into *idiopathic* and *traumatic*; according as it arises from constitutional causes, or from injuries; and also according to its effects, as *trismus*, or contraction of the muscles of the jaw; *opisthotonos*, or bending of the body backward; *emprosthotonos*, or forward inclination; and *tetanus lateralis*, or *pleurosthotonos*, when the body is drawn to one side.

What treatment is to be pursued?—Any existing irritation should be removed; cups and counter-irritants may then be applied to the spine; the patient should be purged freely by cathartics, or by enemata thrown up per anum by means of a long stomach tube; and opium should be administered to such an extent as the case will warrant, and by inhalation of chloroform.

INJURIES AND DISEASES OF THE HEAD.

How is concussion of the brain produced?—By severe falls, or by blows upon the head, by which the brain is very much disturbed.

What are its symptoms?—The patient at first is insensible, or comatose, and aroused with difficulty, and incoherent in his replies; the skin cold; the pulse small and weak; spontaneous vomiting, and involuntary evacuation of fæces sometimes occur. When reaction takes place, these symptoms are sometimes followed by inflammatory ones, as a hard, quick pulse, hot skin, contracted pupil, violent headache, &c.

How should concussion be treated?—In the first stage, or that of collapse, we should avoid bleeding, and endeavour to bring about reaction by cold affusions, ammonia, application of warmth, &c.; avoiding all powerful or permanent stimulants, lest inflammation be excited; and when inflammatory symptoms appear, bleeding, purging, the application of cold to the head, and general antiphlogistic treatment should be adopted, according to circumstances,

What are the causes of compression of the brain?—Extravasation of blood in the cavity of the cranium, depressed fracture, or the formation of pus within the skull.

What are its symptoms?—Slow and labouring pulse, stertorous breathing, dilatation and insensibility of the pupils to light, relaxed

limbs, complete insensibility, from which the patient cannot be roused.

How should compression of the brain be treated?—By bloodletting, purging, and general antiphlogistic measures; and if the compression arise from depressed fracture, it should be elevated, or removed by the trephine, which may also be useful in evacuating extravasated blood, when compression can be relieved in no other way.

How may compression from extravasation be distinguished from that produced by depressed fracture? — By the symptoms of compression occurring in the latter case, immediately after the receipt of the injury, while in the former case some time usually intervenes.

How are fractures of the skull divided? — Into fissure, counter-fissure, depressed, double depressed, or camerated, stellated, and punctated.

What is counter-fissure?—Fracture produced in a part of the skull other than that where the blow was inflicted, owing to the elasticity of the bones of the cranium (as where a blow upon the occiput is followed by a fracture at the temple where the bone is thin).

What render fractures at the base of the skull particularly dangerous? — The great extravasation that generally accompanies them, and the severe inflammatory symptoms that almost invariably follow.

What peculiar symptoms attend this kind of fracture? — Hemorrhage from the ears.

How should fractures be treated?—Upon the general antiphlogistic plan; and the trephine should not be used unless urgent symptoms of compression of the brain are present.

How should depressed portions of bone, causing compression, be treated? — They should be raised, if possible, by an elevator; or otherwise removed by Hey's saw, or by the trephine.

How is the operation of trephining performed? — If a wound of the integuments exist, it should be dilated in such a way as may be necessary, but if the integuments be entire, a crucial or semicircular incision should be made, and the flap or flaps dissected up; the pericranium should then be divided by a movable lancet attached to the trephine (and not rasped away by a raspatory); the surgeon then fixes the sliding centre-pin in the bone, and rotates the trephine until a gutter is formed, when the centre-pin should be raised, and the rotatory movement cautiously continued, frequently removing the trephine to brush away the sawings, and to ascertain, by means of a probe or toothpick, the depth to which the trephine has penetrated. As soon as the bone is sawed through, the fragment should be removed by a forceps, the sharp projections removed by means of the lenticular, and the depressed portion elevated; the coagula, if any exist, should then be suffered to escape, and the wound dressed with adhesive strips, and a light compress and bandage applied.

What peculiar method is necessary to be followed in trephining over the frontal sinus? — A large trephine must be used in cutting

through the outer table, and a smaller one for the inner, owing to the irregular shape of the bone.

What regions of the skull should be avoided in trephining? — The parts immediately over the large sinuses, particularly the occipital.

In what disease has trephining been occasionally successful? — In epilepsy.

How is the vacancy left in the bone by the operation of trephining repaired? — By the thickening of the dura mater and pericranium.

Are wounds of the substance of the brain necessarily fatal?—They are not; large portions of the brain having been removed by accident or by the knife, without material injury.

What is fungus cerebri, or hernia cerebri? — A morbid growth of granulations from the substance of the brain, or of the brain itself, protruding through a wound in the skull.

How should it be treated? — It should be covered with lint soaked in liquor calcis, and over this adhesive strips daily applied to effect its gradual depression; or it may be necessary to use caustic or the knife.

INJURIES AND DISEASES OF THE EAR.

To what injuries is the ear liable? — To wounds of various kinds; to frost-bite; to inflammation of the meatus auditorius; ulceration of the membrana tympani; obstruction of the Eustachian tube; and foreign bodies lodged in the meatus auditorius, polypus, &c.

How may insects or other foreign bodies be removed from the ear? —By the forceps or scoop, or by injecting oil, or milk and water into the external meatus.

How should polypus of the ear be treated? — It should be seized and twisted off by a pair of forceps, and caustic applied to prevent its reproduction.

How is deafness from obstruction of the Eustachian tube to be treated? — By perforating the membrana tympani with a trocar; or by catheterism of the Eustachian tube.

What is otitis or otalgia? — An inflammation of the lining membrane of the tympanum, accompanied by excessive pain in the ear, fever, and, occasionally, delirium.

How does this disease sometimes terminate?—The inflammation is sometimes propagated to the membrane lining the mastoid cells of the temporal bone, giving rise to collections of pus, or terminating in inflammation of the base of the brain.

How should this disease be treated? — In mild cases, injections of tepid milk and water, or the introduction of a drop or two of laudanum into the ear, will sometimes give relief; in severer cases, leeches and blisters behind the ears are necessary; and if suppuration cannot be prevented, it should be evacuated by puncture as soon as formed.

DISEASES OF THE EYE AND ITS APPENDAGES.

What is ectropion?—An eversion of the eyelid, owing to swelling of the conjunctiva, or from contraction produced by burns.

How should it be treated?—When it is owing to swelling or relaxation of the conjunctiva, a portion of that membrane should be excised (by curved scissors), in the form of a V, and the edges tacked together by suture; and when the deformity is owing to contractions from a burn, the cicatrix should be divided.

What is entropion?—An inversion of the margin of the eyelid, from inflammation, or cicatrices upon its lining membrane.

How may the deformity be removed?—By excising a fold of the outer integuments, by means of a curved scissors.

What is trichiasis?—An inversion of the cilia or eyelashes.

What operation is necessary?—Removal of the edge of the eyelids with the roots of the cilia.

To what tumours are the eyelids subject?—To hordeolum or stye, which is a furunculous tumour of the meibomian glands; and to fatty encysted tumours.

How should they be treated?—The former should be treated like common furuncle or boil; and the latter should be removed by the knife.

What is encanthis?—A tumour of the lachrymal caruncle, frequently malignant in its nature.

How should it be treated?—The eyelids should be held apart by the fingers, and the tumour drawn forward by means of a hook, and extirpated.

What are epiphora and stillicidium?—An overflowing of the tears upon the cheek, owing, in epiphora, to undue secretion of tears, or to obstruction of the lachrymal canals, or nasal duct; and in stillicidium, to defective absorption.

How may obstruction of the lachrymal canals be sometimes relieved?—By dilatation with one of Anel's probes.

What is xeroma?—A dry condition of the surface of the eye, from suppression, or obstructed secretion.

What treatment should be adopted?—The eye should be kept moist by wet applications; and sometimes a blister to the temple will be found beneficial.

What is fistula lachrymalis? (Figs. 204, 205, 206.)—An opening in the cheek communicating with the lachrymal sac, through which the lachrymal secretions escape upon the cheek.

From what does this fistula arise?—From inflammation of the lachrymal sac, or from obstruction of the ductus ad nasum.

How may the obstruction of the nasal duct be removed?—By a probe, properly bent, introduced into the nasal duct from beneath the inferior meatus of the nose, or by a probe or narrow-knife introduced into the lachrymal sac, and passed downwards and slightly backward

Fig. 204.

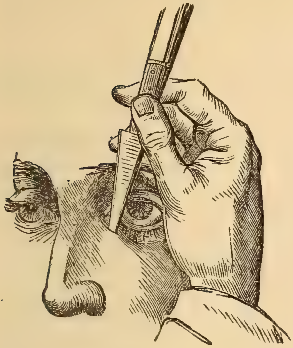


Fig. 205.

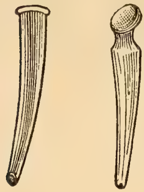


Fig. 206.

in the course of the nasal canal, until it reaches the inferior meatus of the nose; it is then to be withdrawn, and a nail-headed style worn to keep the passage open.

What operation must be substituted for this, when the bony canal of the lachrymal duct is obliterated?—A perforation should be made into the nose through the os unguis, which should be supported during the operation by a piece of horn carried up the nostril.

What is pterygium?—A membrane growing generally from the internal, but sometimes from the external, angle of the eye, or from both, and gradually covering the cornea.

How should it be treated?—Where it consists merely of a mesh of vessels, it is often sufficient to divide the vessels supplying it; but if it be fleshy, constituting what is called a pannus, it must be lifted up by forceps or a hook, and dissected off with curved scissors.

What is ophthalmia?—A conjunctivitis, or inflammation of the conjunctiva.

What is the simplest form of ophthalmia?—Catarrhal, arising from exposure to heat or cold, or intense light, or from mechanical injuries.

What are its symptoms?—An injected state of the vessels of the conjunctiva, sometimes producing chemosis, or an elevated bloody ring around the cornea, with pain, and intolerance of light; dryness of the eye at first, followed afterwards by a copious discharge of tears and mucus, often kept up by granular lids.

What treatment is demanded in this affection?—General and local blood-letting, purging, blisters behind the ears, and collyria of lead water, in the acute stage; but if the disease become chronic, strong astringent lotions, or the application of nitrate of silver may be necessary, or cupri sulph.

What is purulent, or Egyptian ophthalmia?—A very violent form of ophthalmia, accompanied by intense pain, and swelling of the ball

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of the eye, with, in most cases, early and profuse secretion of pus, and frequently terminating in sloughing of the cornea, or in a granular condition of the conjunctiva, or in bursting of the coats of the eye and evacuation of its humours.

What is gonorrhœal ophthalmia? — An aggravated and very rapid form of purulent ophthalmia, arising from contact of the matter of gonorrhœa.

What is the proper treatment? — Depletion, both general and local, to as great an extent as can be borne; and mercurials should be tried in the first stage of the affection, with vapours of opium, and, as some recommend, the free application of nitrate of silver to the conjunctiva; and when suppuration has taken place, tepid injections, collyria of corrosive sublimate, or of lead water, or red precipitate, or citrine ointment, or the nitrate of silver will be useful, or cupri sulph.

What is scrofulous ophthalmia? — A form of conjunctivitis almost exclusively confined to children of scrofulous habit, and indicated by moderate vascularity of the conjunctiva, copious secretion of tears, and great intolerance of light, with little or no pain.

How does this disease sometimes terminate? — In ulceration of the cornea, or specks, from deposition of opaque matter in its substance.

What treatment should be pursued in scrofulous ophthalmia? — Bleeding should be avoided as injurious, and tonics and alteratives administered, with the use of the salt water bath, pure air, &c., and local applications, in the form of opiate fomentations; and after the acute symptoms have subsided, or ulcerations have taken place, collyrium of corrosive sublimate, and the application of nitrate of silver should be employed; as a general remedy, cod liver oil is highly beneficial.

What is psorophthalmia? An inflammation of the edges of the eyelids, accompanied with pain, itching, and falling out of the eyelashes; frequently causing adhesion of the eyelids.

From what does psorophthalmia arise? — It generally arises from measles, small-pox, or from a scrofulous diathesis.

How should it be treated? — By mild astringent collyria; and when it occurs from a scrofulous constitution, the internal exhibition of iron, iodide of potassium, the use of the salt water bath, and a nutritious diet should be inculcated, and the application of the solid nitrate of silver to the lids, and afterwards dressing them with weak red precipitate ointment.

What is sclerotitis? — An inflammation of the sclerotic coat of the eye, occurring in adults, and sometimes rheumatic in its character.

How may it be recognised? — By a deep-seated, diffused redness of the globe of the eye, forming an elevated circle around the cornea, throbbing, or darting, or stinging pain; a sensation of fulness and distension, with occasionally an alteration in the shape of the globe of the eye; intolerance of light, and increased lachrymation.

How does this disease frequently terminate?—It frequently involves the other coats of the eye, and terminates in destruction of the eye itself.

What treatment is proper in this affection?—Where the affection is purely inflammatory, and the patient robust, the antiphlogistic plan should be pursued; but in many cases this will be found injurious, and our principal dependence must be upon local applications of nitrate of silver, red precipitate ointment, collyria of corrosive sublimate, wine of opium, and belladonna ointment.

What is keratitis, or corneitis?—An inflammation of the substance of the cornea, generally attacking young persons.

What are its symptoms?—The cornea gradually loses its brilliancy and transparency, and becomes covered with well-defined, elevated red patches of minute blood-vessels; and, when the neighbouring tissues are not involved, unaccompanied by increased lachrymation, or intolerance of light, and rarely with pain; but sometimes conical projection of the cornea takes place, from increased secretion of the aqueous humour.

What treatment is required in simple keratitis?—Local and sometimes general depletion, and counter-irritation, or antimonials, combined with quinine, or calomel and opium, may be required.

What is iritis?—An inflammation of the iris, from injuries, operations, or from syphilitic or mercurial poison.

How is it indicated?—By discolouration of the iris, and development of red vessels running into it from the margin of the cornea, contraction of the pupil, acute pain, and intolerance of light.

How does iritis generally terminate?—In effusion of lymph (rarely in suppuration), and sometimes in obliteration of the pupil.

How should iritis be treated?—In the simple form, general and local bleeding, counter-irritation, and the use of mercury, belladonna, and stramonium to subdue inflammation, and prevent adhesion; and where it arises from syphilitic taint, or abuse of mercury, the iodide of potassium will be serviceable (the exhibition of turpentine is also strongly advised).

From what may opacity of the cornea proceed?—From partial thickening of the cornea, or from effusion of lymph between its coats, or from a cicatrix.

How may it be removed?—When it is caused by a cicatrix, it is incurable; when it proceeds from thickening of the coats, or from lymph between them, the application of citrine ointment, or nitrate of silver, or calomel, or finely-powdered sugar blown into the eye, or the application of molasses, or weak vinegar, will often be useful, or powdered cadmium.

What is procidentia iris?—A protrusion of the iris through a wound in the cornea, or through an opening in it formed by ulceration

How should it be treated?—It should be replaced, and the wound

or ulcer healed as speedily as possible; or, if it cannot be replaced, the protruding part may be removed by caustic.

How should obliterated pupil be treated? — An artificial opening may be made by a knife or needle, introduced either before or behind the iris.

What name is given to effusion of pus between the layers of the cornea, or in the anterior chamber? — In the former case it is called onyx, and in the latter hypopion.

What treatment is to be pursued? — Evacuation by puncture is very hazardous, and should not be attempted; but general antiphlogistic measures should be adopted.

What is staphyloma? — A conical projection of the cornea, generally opaque, and sometimes preventing closure of the eyelids.

How should it be treated? — The only remedy is the removal of a flap of the projecting cornea by the knife.

What is cataract? — An opacity of the crystalline lens, or of its capsule, or both, either congenital, or produced by subsequent injury or disease.

How are cataracts divided?—Into capsular, lenticular, and capsulo-lenticular, according as the capsule, or lens, or both, are affected.

How may cataract be detected? — When it is produced after birth by gradually increasing dimness of sight, the patient being able to see better when the pupil is expanded in faint light, or by the application of stramonium or belladonna; and by inspection, showing the opacity of the lens, which is of a white, gray, black, or mottled appearance, and increased in size in fluid cataract, and diminished when the cataract is solid; and by catoptric examination of the eye, which is done as follows: When a lighted candle is held before the eye, three images of it are seen, two erect, and one inverted; the former owing to reflections from the cornea and anterior surface of the crystalline lens, the latter owing to reflection from the posterior layer of the crystalline. In amaurosis all the images are seen, in cataract either one or two are not seen, or varied in distinctness.

What is necessary for the cure of cataract? — The removal of the crystalline lens.

What are the operations in use for this purpose? — Couching, extraction, and the absorbent operation.

What is couching? — The depression of the lens from the axis of vision, by means of a straight or curved couching needle.

How is couching performed? — The pupil of the eye having been previously dilated by means of belladonna or stramonium applied to the eyebrow, the sound eye should be bandaged, and the patient seated on a low stool; an assistant then supports the head, and keeps the upper eyelid open by the fingers, or by a speculum, and the surgeon, standing before the patient, depresses the lower lid and fixes the ball of the eye, while he introduces the needle from the external angle of the eye, and penetrates the sclerotica two lines behind the edge of

the cornea, until the point of the needle is seen behind the lens; the capsule is then lacerated, and the lens pressed downwards into the vitreous humor, taking care not to withdraw the needle until it be seen whether the lens does not arise again.

How is extraction performed? — The patient should be seated and the eyelids secured as in the operation for couching; the surgeon then steadies the globe of the eye with the fore and middle fingers of one hand, while with the other hand he introduces a triangular knife of Wenzel or Beer through the cornea, a quarter of a line from its junction with the sclerotica externally, and carries it, with the cutting edge downward, horizontally across the anterior chamber until its point emerges in front of the internal margin of the cornea; the knife is still to be pushed forwards until it cuts itself out; the flap of the cornea must now be raised with a currett, and the capsule of the lens lacerated with a needle or wire, when the lens will generally escape through the lacerations in its capsule, and through the incision in the cornea; the edges of the cornea should then be adjusted, and the eyelids secured together by adhesive strips and a light bandage.

What are the disadvantages of this operation? — It is liable to be followed by considerable inflammation; and there is danger of the iris falling under the edge of the knife, or the vitreous humour being evacuated by the pressure made upon the eye to facilitate the expulsion of the lens.

What treatment may be adopted to prevent the iris from falling under the edge of the knife? — Friction of the cornea during the passage of the knife.

How is the operation for absorption performed? — By the anterior operation (called *keratonyxis*, or puncture of the cornea), and by the posterior operation.

How is keratonyxis performed? — The pupil is dilated by belladonna or stramonium, and the patient seated and the eyelids secured as in the former operations; a sharp needle, gradually tapering towards the point, is then carried through the cornea anteriorly, near its margin, and the capsule and lens lacerated; the needle is then withdrawn, and the fragments of the lens are gradually dissolved by the aqueous humour, and absorbed.

What are the difficulties and disadvantages of this operation? — The adhesion of the cornea to the needle interfering with its free motion, and the operation frequently must be repeated two or three times.

How does the posterior operation differ from keratonyxis? — The needle is passed through the sclerotica at the distance of a line behind its junction with the iris, and the lens and capsule divided in different directions, and the fragments pushed into the anterior chamber to be dissolved by the aqueous humour.

What is amaurosis? — Partial or complete loss of sight, from insen-

sibility of the optic nerve, without any perceptible alteration in the appearance of the eye.

From what causes does it arise? — From local plethora; from gastric derangement; from congestion of the brain; from general debility; or from narcotics or poisons, in which cases it is said to be functional; or it may arise from organic disease of the brain or of the eye itself, in which case it is called organic.

What is the proper treatment of amaurosis? — Organic amaurosis is generally incurable; functional amaurosis may be relieved by the removal of its causes, by appropriate constitutional and local treatment; and sometimes by blisters; or by strychnine exhibited internally or endermically.

What is glaucoma? — A disease of the hyaloid membrane and vitreous humour, characterized by a greenish, shining appearance at the bottom of the eye, usually accompanied by irregular dilatation of the pupil and loss of vision.

What treatment is proper? — The disease is almost always incurable, but the liquor potassæ arsenitis is said to have been sometimes useful.

DISEASES OF THE NOSE AND ANTRUM.

POLYPUS OF THE NOSE.

What is a polypus? — A soft, spongy, pendulous tumour, arising from a mucous membane.

Describe polypus of the nose. — It rises, by a broad base or by a narrow neck or pedicle, from the Schneiderian membrane; and occupies the anterior or posterior nares, giving rise to laborious and noisy respiration.

What peculiar effect is produced upon nasal polypus by hydrometrical changes? — The polypus enlarges very much in damp weather, and contracts again when the weather is dry.

How may polypus nasi be removed? — It may be twisted off by the forceps, or removed by the knife, when it has a narrow neck or pedicle; or it may be strangulated by one or more ligatures passed around or through its substances; the ligature being generally preferred on account of the hemorrhage which frequently follows the removal by the knife or forceps. Dr. Gross has lately succeeded by means of the ordinary carpenters' half-inch "gouge."

OZŒNA.

What is ozœna? — A fœtid discharge, owing to a peculiar inflammation of the pituitary membrane, and sometimes destroying the cartilages and bones of the nose.

What treatment is to be adopted in this affection? — Injections of a solution of chloride of lime, or fumigation with hydrargyri sulphuretum nigrum, or nitrate of silver.

FUNGUS OF THE ANTRUM.

What peculiarity does fungus of the antrum exhibit?—A peculiar tendency to become malignant.

What effects are produced by polypus of the antrum?—Protrusion of the bones of the cheek, of the eye, and of the teeth, with great deformity.

What treatment may be adopted?—If undertaken early, the diseased parts may be removed, and the patient recover; but the operation very generally fails, from extensive morbid degeneration of the surrounding tissues, and the return of the disease after the operation.

DISEASES OF THE MOUTH.

ENLARGEMENT OF TONGUE.

From what cause does the tongue become enlarged?—From injuries of the tongue, or the abuse of mercury, giving rise to glossitis or inflammation of the tongue with enlargement, or from simple hypertrophy, or excessive growth.

How should enlargements of the tongue from glossitis be treated?—By leeching, free scarification of the part, and by general depletion.

What operation is sometimes necessary in hypertrophy of the tongue?—Removal of part of the tongue by the knife, or by a ligature passed through its middle, and tied on each side. [For hare-lip, see *Deformities, &c.*]

RANULA.

What is ranula?—A small tumour beneath the tongue, arising from obstruction of the ducts of the sublingual glands.

From what does it derive its name?—From its appearance, which resembles the belly or cheeks of a frog.

What remedy is required?—Laying open the tumour, or excising a portion of it.

EPULIS.

What is epulis?—A tumour of the gum, arising from the sockets of the teeth, and frequently becoming malignant.

What operation is required?—Removal by the knife and saw.

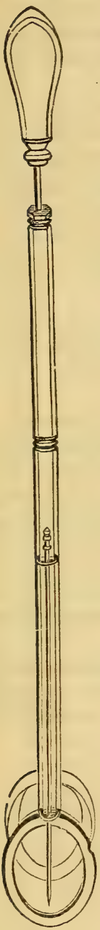
ENLARGED TONSILS AND UVULA.

What treatment may be tried in enlargement of the tonsils?—Astringent gargles and powders applied locally, and the internal use of iodine, touching with argenti nitratum; and, if this be not successful, it should be removed by the knife.

How should enlarged uvula be treated?—Astringents may be tried, as in enlargement of the tonsils, and if this be unsuccessful, it should be cut off.

What instruments are usually employed in removing enlarged tonsils and uvula? — The guillotine of Fahnestock, (Fig. 207,) or Gibson's modification of Physick's tonsil forceps; or the tonsils may be drawn out by a double hook and cut off by a probe-pointed bistoury.

Fig. 207.



DISEASES OF THE NECK.

OBSTRUCTIONS OF THE ŒSOPHAGUS AND TRACHEA.

How may the œsophagus be obstructed? — By foreign bodies lodged in it, and by stricture and contraction of its calibre.

How should foreign substances be removed from the œsophagus? — By an emetic, by position, and by extracting them by means of the gullet forceps, or when this cannot be accomplished, they should be pushed down into the stomach by a probang, or a piece of sponge fastened to a piece of whalebone.

How is stricture of the œsophagus to be treated? — It should be gradually dilated by the repeated introduction of the stomach tube, and if it be owing to spasm or inflammation, nauseants and local bleeding may be useful.

What caution is necessary? — When the obstruction proceeds from malignant tumours in the œsophagus, or from aneurism of the aorta, the introduction of the stomach tube ought not to be attempted, lest the disease be aggravated, or the aneurism ruptured.

How may the larynx and trachea be obstructed? — By tumours from their sides; by œdema of the mucous membrane; or by the introduction of foreign bodies into their cavities.

What operations are resorted to in order to remedy obstructions from the larynx and trachea? — Laryngotomy and tracheotomy.

How is laryngotomy performed? — An incision is first made, through the integuments in the front of the neck, over the crico-thyroid ligament, and the divided vessels secured if necessary; the crico-thyroid ligament is then divided, and, if necessary, the incision may be carried upwards, separating the sides of the thyroid cartilage.

What is sometimes necessary to enable the patient to breathe freely, in cases of obstruction of the larynx? — The introduction of a silver canula.

How is tracheotomy performed? — The patient should be seated in a chair, and the head thrown back; an incision is then made through the integuments, beginning below the cricoid cartilage and carried

downwards towards the sternum; the sterno-hyoid and the sterno-thyroid muscles, the isthmus of the thyroid gland and the blood-vessels are pushed out of the way; the patient is then made to elongate and stretch the windpipe by imitating the action of swallowing, at which moment the surgeon pushes the knife, with its back to the sternum, through the trachea, at the lower part of the incision.

BRONCHOCELE, OR GOITRE.

What is bronchocele?—A tumour of the thyroid gland, frequently giving rise to difficulty of respiration, from its pressure upon the trachea.

What treatment is to be pursued?—The only reliance is upon the internal and external use of iodine; any attempts at extirpation being almost invariably followed by profuse and frequently fatal hemorrhage.

PARACENTESIS.

What is meant by paracentesis?—The evacuation of a fluid from any one of the cavities of the body, by puncturing its walls.

How is paracentesis of the chest performed?—The patient should be seated in an upright position, and if the matter point at any particular part, the incision should be made there; if not, an incision should be made through the integuments just above the seventh rib, and about four inches from the spine; the skin having been previously drawn up so that the opening in the integuments and that through the intercostal muscles may not be exactly over one another; an opening is then made through the intercostal muscles and pleura, sufficiently large to admit a canula or a gum catheter, which must then be introduced, taking care not to evacuate too large a quantity of the fluid at one time, for fear of inducing prostration.

How is paracentesis of the abdomen performed?—The patient's abdomen should be surrounded with a bandage having tapes or straps attached, or split at its extremities into several strips; the bladder should first be evacuated, and an opening then made in the linea alba a little below the umbilicus (or in case of ovarian dropsy, immediately over the diseased part), by means of a lancet, and a canula introduced, taking care to tighten the bandage as the fluid escapes, and not to evacuate the whole of the fluid at once.

POISONS IN THE STOMACH.

What treatment is required when poisons have been introduced into the stomach?—They should be removed by the stomach-pump, or by emetics, or appropriate antidotes and demulcents administered.

HERNIA.

What is meant by hernia?—A protrusion of any viscus from its proper cavity; but the term is generally used to signify a protrusion of intestine or omentum, covered with peritoneum.

What are the causes of hernia?—It is sometimes congenital, but generally arises from violent muscular exertion, or blowing wind-instruments, in persons whose abdominal rings are naturally large; sometimes in females from pregnancy; or in children, from violent fits of coughing or crying.

Of what is the sac constituted in hernia? — Of the peritoneum, which is pushed before the intestine.

How is hernia divided? — Into reducible hernia, when the protruded part returns readily into the abdomen; irreducible, when the return of the intestine or omentum is prevented by adhesion to the sac, or from great increase in their volume; and strangulated hernia, when the protruded parts are so tightly embraced as to obstruct the circulation, giving rise to twisting pain around the umbilicus, vomiting of stercoraceous matter, constipation, singultus, small quick pulse, cold clammy skin, and anxious countenance, terminating, if not relieved, in death; or in sloughing of the protrusion, and formation of artificial anus.

How should reducible hernia be treated? — When it arises from adhesions, little else can be done than to support it by a bag truss; but where it arises from increased growth, depletion and abstinence may succeed. (The application of ice to the tumour has also proved successful.)

How is hernia rendered *strangulated?* — By the bowel becoming distended with flatus; or by a large portion of intestine, or omentum, being forced through the ring by sudden or violent exertion.

How should it be restored? — The patient should be placed so as to relax the muscles of the abdomen, and taxis should be employed, gradually and steadily, for half an hour; and if this should not succeed, the stricture must be divided by the knife, and the hernia reduced.

What means are sometimes resorted to, in order to facilitate restoration by taxis? — The warm bath, opium, nauseating medicines, the inhalation of ether or chloroform, or dashing cold water upon the tumour, and tobacco injections. (The introduction of the stomach tube into the rectum, to encourage the escape of the flatus, has also been found useful.)

How may an intestinal hernia be distinguished from one containing only omentum? — By the elasticity and smoothness of the former, and the gurgling noise it produces in passing into and out of the abdomen; and the doughy, inelastic, irregular feel of the latter.

What are the varieties of exomphalos or umbilical hernia? — The congenital variety, in which the omentum, or intestine, protrudes into the umbilical cord, and is not covered by the skin; and the variety occurring in adults, or children after birth, in which the hernia is covered by the common integuments.

How should congenital umbilical hernia be treated? — The hernia should be reduced, and a truss or compress applied; or the sac and skin around the umbilicus embraced by a ligature, so as to cause

sloughing of the parts included, and cicatrization of the umbilical ring.

How should the reducible form of the variety occurring in adults be treated? — The parts should be restored, and a truss applied to retain them.

How is the operation for strangulated umbilical hernia performed? — The patient should be placed upon a table in such a position as to relax the abdominal muscles; an incision is then made through the skin, crossing the tumour transversely at its middle; another incision is made perpendicularly to the first, so that the two unite in the form of the letter T; the flaps must then be dissected up, and the superficial fascia pinched up and divided; the hernial sac, if it has not been absorbed, should be carefully cut into and divided upon a director; the finger should then be carried within the sac to the upper part of the stricture, and a probe-pointed bistoury (with its edge covered to within an inch of its point), introduced along the finger, and the stricture divided upward in the linea alba, to a sufficient extent to allow the intestine to be restored.

What caution is necessary with regard to restoring an intestine that has been strangulated? — If mortification of the intestine has taken place, it should not be restored, as the patient's only chance of safety depends upon the formation of an artificial anus; and if small mortified spots appear upon the intestine, they should be surrounded by a fine ligature before the bowel is returned.

What treatment is necessary after the operation for strangulated hernia? — The patient should be kept upon his back, with the muscles relaxed, until the parts are united, and a truss should be worn to prevent a recurrence of the hernia.

What is an inguinal hernia? — A protrusion of bowel or omentum, or both of them, into or through the inguinal canal.

What name is given to a hernia contained between the internal and external abdominal rings? — Concealed inguinal hernia.

What is scrotal hernia? — A form of inguinal hernia, in which the bowels descend into the scrotum.

How may scrotal hernia be distinguished from varicocele, or from hydrocele? — By the disappearance of the varicocele when the patient is in the recumbent position, and its return when he rises, although the finger be kept at the abdominal ring; and from hydrocele, by the latter disease commencing at the bottom of the scrotum, and increasing upwards.

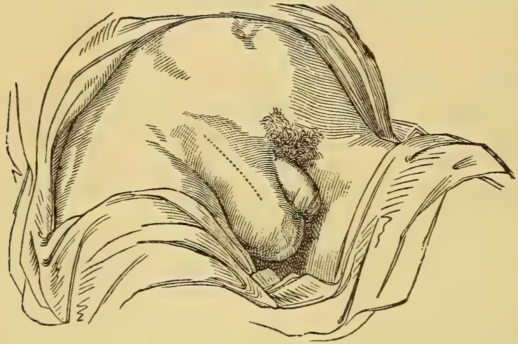
What is the course of inguinal hernia in escaping from the abdomen? — It enters the internal abdominal ring formed by the fascia transversalis, passing under the edges of the internal oblique and transversalis muscles, and between the cremaster and the cord; and, following the course of the cord through the inguinal canal, emerges through the external abdominal ring, formed by the splitting of the fibres of the tendon of the external oblique muscle.

What form the coverings of inguinal hernia? — The skin, the fascia superficialis, the cremaster muscle; and to these is added, in concealed inguinal hernia, the tendon of the external oblique, and sometimes a few fibres of the internal oblique and transversalis muscles.

How should inguinal hernia be reduced? — The patient should be placed on his back, with his pelvis and legs elevated, to relax the abdominal muscles; taxis should then be tried by supporting the tumour with one hand, while, with the other hand, the tumour is gently pressed or kneaded in the direction of the abdominal ring; and after the hernia is restored, a truss should be applied over the lower part of the internal abdominal ring.

How is the operation for strangulated inguinal hernia performed? (Fig. 208)—The patient is placed on his back upon a table, and the pelvis and

Fig. 208.



legs supported to relax the muscles; an incision is then made through the integuments over the tumour, from above downwards, nearly its entire length; the fascia superficialis and cremaster are next to be carefully divided, and the hernial sac pinched up, and divided upon a director; a probe-pointed bistoury, with its edge covered to within an inch of its point, must be carried (along the finger as a guide) to the edge of the stricture, which must be divided to a very slight extent in a direction directly upwards, to avoid wounding the epigastric artery, which runs on the inner side of the internal ring; and the hernia then should be returned.

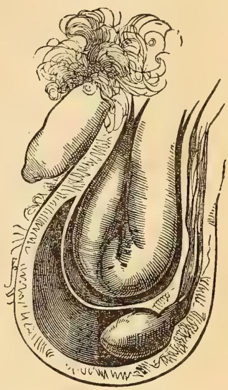
What after-treatment is necessary? —The edges of the incision should then be approximated by adhesive strips or by sutures, and the patient not permitted to rise from his back until perfect union has taken place, and a truss should afterwards be worn to prevent a recurrence of the hernia.

What medical treatment is necessary? — To keep the bowels freely opened for some days after the operation, to avoid irritation and inflammation.

What small artery is generally cut across in the operation for strangulated inguinal hernia?—The *arteria ad cutem abdominis.*

How does congenital hernia differ from common inguinal hernia? (Fig. 209.)—In congenital hernia, the bowel descends into the scrotum through the tunica vaginalis, before the communication between the tunica vaginalis and the abdomen is closed.

Fig. 209.



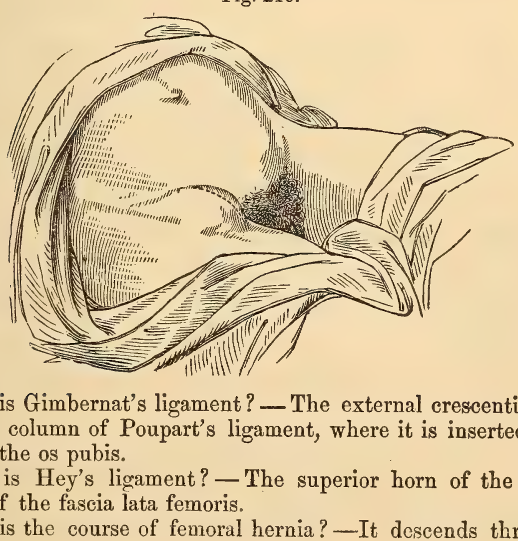
What forms the hernial sac in this case?—The tunica vaginalis, which contains also the cord, behind the protruded bowel.

How does the treatment of congenital hernia differ from that of the common inguinal form?—The reducible form may often be radically cured by means of a proper truss; and when the operation for strangulated hernia is necessary, the incision, in the tunica vaginalis, should not be lower down than the upper part of the testicle.

What is femoral hernia? (Fig.210 .)—A hernia escaping through the crural ring.

What form the sides or boundaries of the crural or femoral ring?—The os pubis posteriorly, Poupart's ligament anteriorly, the iliac vessels externally, and Gimbernat's ligament internally.

Fig. 210.



What is Gimbernat's ligament?—The external crescentic edge of the outer column of Poupart's ligament, where it is inserted into the spine of the os pubis.

What is Hey's ligament?—The superior horn of the falciform process of the fascia lata femoris.

What is the course of femoral hernia?—It descends through the

sheath of the vessels, on the inner side of the femoral vein, and escapes through one of the openings at the inner side of the sheath of the femoral vessels, carrying with it a portion of the loose cellular tissue of the sheath, which thus constitutes the *fascia propria.*

How should taxis be made in femoral hernia?—In a downward and inward direction, until the tumour is below Poupart's ligament, and then gently upwards.

How is the operation for strangulated inguinal hernia performed? —The patient should be placed upon his back with the shoulders and pelvis elevated, to relax the muscles; the bladder should be emptied, and the parts shaved; an incision should then be made through the skin over the tumour, commencing a little above Poupart's ligament, and extending downwards and somewhat inwards as far as the middle of the protrusion; and this incision should be joined at right angles by another, forming with it a reversed ⊥; the fascia superficialis and fascia propria should then be pinched up and carefully divided, and after them the hernial sac; the finger should now be introduced between the sac and the intestine, until it meets with the stricture, when a probe-pointed bistoury, guarded as in the operation for inguinal hernia, should be carried along the finger, and the stricture divided to a very slight extent in a direction upwards, so as to avoid the epigastric and obturator arteries.

Where is the stricture situated?—Either at Hey's ligament, in the sheath of the vessels at the mouth of the sac, or at Gimbernat's ligament.

In which sex does femoral hernia most frequently occur?—In the female.

How may it be distinguished from inguinal hernia?—By the direction in which an impulse is given to the tumour by coughing; and by drawing down the tumour, Poupart's ligament may be traced above it when the hernia is femoral, but not when it is inguinal.

What peculiarity is required in the truss for femoral hernia?—The pad should project downward at right angles with the spring of the truss, and should press upon the opening through which the hernia escapes under Poupart's ligament, and also upon the upper part of the thigh.

How is artificial anus formed?—By the sloughing of the strangulated portion of the intestine, and the adhesion of the sound parts to the neck of the sac.

What prevents the passage of fæces from the upper to the lower part of the bowel in artificial anus?—The projecting ridge formed by the contiguous walls of the upper and lower portions of the intestine that was strangulated.

How may this be remedied?—Complete union of the contiguous walls forming the projecting ridge should be accomplished by passing a ligature through them, and keeping it there until the contiguous portions of intestine are united by adhesive inflammation; the pro-

jecting ridge may then be divided, in such a way as to create a communication between the upper and lower portions of intestine.

DISEASES OF THE RECTUM AND ANUS.

How should stricture of the rectum be treated? — If it proceed from spasm, tepid injections, warm bath and other relaxing means should be tried, and if unsuccessful, or the stricture be permanent, dilatation should be attempted by the gradual and repeated introduction of a bougie; and it has also been recommended to notch the stricture at several points with a knife.

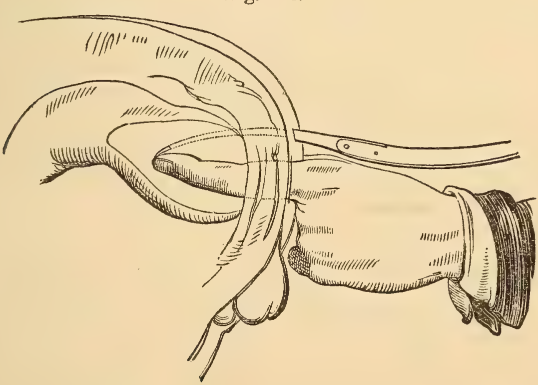
What is fistula in ano? — An artificial canal extending alongside of the rectum, and lined by an artificial membrane which secretes pus.

How are fistulæ divided? — Into internal fistula, when it communicates with the cavity of the rectum, and not externally with the skin; incomplete fistula, when it opens upon the integuments, but not internally; and complete fistula, when it communicates both with the rectum and the integuments.

How should fistula in ano be treated? — Emollient poultices, perfect rest, and mild laxatives, should be tried, and if these prove unsuccessful, an operation should be performed by the knife or ligature.

How is the operation by the knife to be performed? (Fig. 211.) — The bowels should be previously evacuated by laxatives and enemata;

Fig. 211.



the patient then stoops over a table, and the buttocks are held asunder by an assistant, while the surgeon introduces a finger, lubricated with lard or oil, into the rectum, and by means of a probe passed into the fistula, he ascertains its direction and extent; a probe-pointed bis-

toury is then introduced through the internal orifice of the fistula into the rectum, and the finger and knife withdrawn together, dividing the parts included between them.

What is necessary in incomplete fistula? — A sharp-pointed bistoury must be used, and carried through into the rectum at the upper extremity of the fistula, and cut out, as in the former case; lint should then be interposed between the external lips of the wound, to insure its healing from the bottom; and the patient kept quiet till union is complete.

What danger attends this operation? — Profuse hemorrhage sometimes occurs from division of the large veins around the anus.

How is the operation by the ligature performed? — If the fistula be incomplete, a communication must be made between it and the rectum, by a stilet carried up through a curved canula; a ligature may then be passed from the fistula into the rectum by means of a watch-spring and canula, as recommended by Bellocque; the ends of the ligature are then tied, at first loosely, and daily tightened until it makes it way through the skin.

What is encysted rectum? — Enlargement of the lacunæ, or mucous follicles of the rectum, giving rise to irritation and pain after defecation.

How should they be treated? — They should be drawn down by means of a blunt probe, and removed by a knife or scissors.

What is meant by fissure of the anus, and what is its treatment? — This arises from an ulceration of the skin and mucous membrane at the border of the anus, giving rise to itching and pain. It may be relieved by emollient poultices, with laudanum or extract of stramonium placed upon, by the use of blackwash, or touching with nitrate of silver, attending to the digestive organs, and keeping the contents of the bowels in a soft state by sulphur. In some instances, excision of the part becomes necessary, or the sphincter ani divided.

What are hemorrhoids or piles, and how are they divided? — Painful tumours in the lining membrane of the rectum, near the anus, generally arising from varicosity of the veins of the rectum, or an abnormal development of the submucous cellular tissue. They are divided into external and internal.

What are the exciting causes of these tumours? — Constipation, the use of drastic purgatives, severe exercise, pregnancy, &c.

What are the symptoms of piles? — Pain in the loins, irritation and uneasiness in the rectum, and the protrusion of smooth, round, erectile tumours, sometimes bleeding, and sometimes blind, or unaccompanied by hemorrhage.

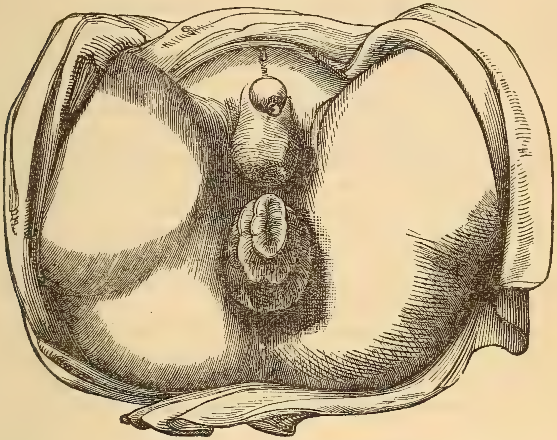
What remedial means may be employed? — Laxative diet and medicines, astringent washes and ointments, leeches, cold enemata; and when the piles are indolent, the internal exhibition of the confectio piperis nigri, or sulphur.

How may piles be radically removed? — By strangulating the pile

by means of a ligature passed through it by a needle, and tied on both sides; or by strangulation by a wire ligature.

What is prolapsus ani? (Fig. 212.) — A protrusion, externally, of

Fig. 212.



the mucous coat of the rectum, from relaxation of the parts, or from violent straining at stool.

How should it be treated?—The prolapsed bowel should be restored, and supported by a proper bandage, and laxatives, astringent washes, and ointments used to overcome the tendency to recurrence; or a portion of the prolapsed mucous membrane may be excised, or removed by ligature, as in hemorrhoids.

How should imperforate anus be treated? — If the anus be simply closed by a membrane, this should be opened by making an incision with a lancet or bistoury, and crossing it; but if the gut be dilated for some distance, the cul-de-sac formed by its extremity should be dissected for, carefully avoiding the bladder; or by opening the descending colon under the kidney.

DISEASES OF THE GENITO-URINARY ORGANS.

How does retention of urine differ from suppression? — In suppression of urine none is secreted, owing to some affection of the kidney, and in retention the urine is secreted and accumulates in the bladder, but the patient is unable to evacuate it.

From what does retention of urine proceed? — From strictures or other obstructions of the urethra; or from paralysis, or spasm of the neck of the bladder, arising from blows upon the perineum, injuries of the spine, from the internal or external use of cantharides, &c.

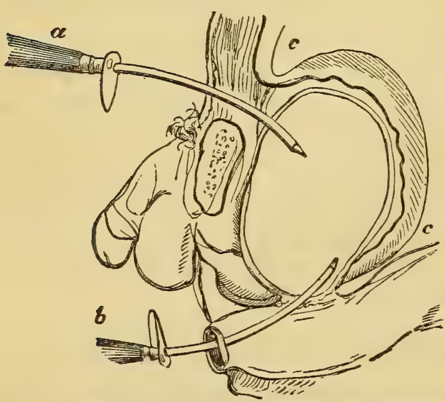
What treatment should be adopted?—If spasm exist, it should be relieved by bloodletting, the warm bath, nauseating medicines, and opiate enemata, or by the introduction of a catheter.

Describe the manner of introducing a catheter.—The patient should be placed in such a position as to relax the muscles of the abdomen and thighs; the surgeon then places himself on the left of the patient, and takes hold of the penis by the thumb and first two fingers of the left hand, on either side of the glans, so as not to compress the urethra; he then takes a catheter (previously warmed and oiled), between the thumb and first two fingers of his right hand, and introduces it carefully in the urethra, with the concavity of the instrument toward the abdomen; the instrument is then to be carried gradually forward through the urethra, directing the back of the instrument along the superior wall of the canal until it reaches the triangular ligament; when this is felt, the surgeon should endeavour to catch it in the concavity of the catheter; and having succeeded, he lets go the penis, and depresses the handle of the instrument between the thighs, when it passes readily into the bladder.

What operation is necessary when the urethra is permanently obstructed, so as not to allow of the introduction of a catheter?—Puncture of the bladder above the pubis or through the rectum.

How is the bladder punctured above the pubis? (Fig. 213.)—The patient is laid upon a table, and an incision is made above the pubis between the pyramidales muscles, through the integuments, until the bladder is perceptible; a puncture is then made through the bladder, by means of a long curved trocar and canula, and the urine evacuated through the canula, which must be retained by tapes and bandages.

Fig. 213.



What are the objections to this operation?—The irritation created by the presence of the canula in the bladder, and the danger of the urine escaping into the cavity of the abdomen.

How should puncture of the bladder from the rectum be performed? (Fig. 213.)—The finger should be carried up the rectum as a guide, and the trocar carried through the coats of the rectum and bladder just above the prostate gland, where the bladder is not covered with peritoneum.

What is incontinence of urine? — An inability to retain the urine in the bladder. (It passing away sometimes drop by drop, and in some cases by sudden and incontrollable gushes.)

What remedies are useful?—Tonics, cold baths, opium, blisters to the sacrum, tincture of cantharides, and strychnine.

What is meant by urinary calculus? — A concretion of alkaline or earthy substances deposited by the urine.

Where are urinary calculi formed? — In the kidney, or in the bladder.

What are the symptoms of calculus, or stone in the kidney? — Obtuse pain in the lumbar regions, especially on stooping; tenderness on pressure; and sometimes discharge of bloody urine.

How does renal calculus, or stone in the kidney, terminate? — In the passage of the calculus, through the ureter into the bladder, or in ulceration and suppuration of the kidney; and sometimes the stone is discharged through an ulcerated opening in the loins.

What is the treatment proper in gravel, or where the alkaline or earthy substances do not become aggregated, but pass into the urine? — To attend to the digestive organs of the patient, correct the peculiar diathesis of the patient, as regards the urine, which may be done by testing the urine frequently, and using such remedies as have a tendency to neutralize the predominant characteristics of the urine, which go to form the calculus.

What symptoms are produced by the passage of a calculus along the ureters? — Sometimes no pain is experienced; but frequently the passage of a calculus is indicated by excruciating pain shooting from the loins along the course of the ureters, accompanied with frequent desire to urinate, spasmodic retraction of the testicle, nausea, vomiting, and cold perspiration.

What is the proper treatment in this affection? — The warm bath, bleeding, opiate enemata, fomentations to the abdomen, and the administration of the oil of turpentine, or of the inspissated Venice turpentine, or of the tincture of phytolacca, or pokeberry.

How does this affection generally terminate? — The patient is generally relieved by the stone escaping from the ureter into the bladder, but sometimes death takes place from obstruction of the ureter.

How may calculous deposits exist in the bladder? — Either free, or encysted.

What is meant by an encysted calculus? — One contained in a pouch or sac, formed by the coats of the bladder; and seldom producing severe symptoms.

What are the symptoms of stone in the bladder? — Inability to use violent exercise without pain; frequent desire to urinate, and passage of bloody urine; severe cutting or scalding pain in the urethra and glans upon urinating, for which the patient compresses the glans, or elongates the prepuce; violent tenesmus, and straining to evacuate

the contents of the bladder; sudden stoppage of the flow of urine, caused by the stone acting as a valve, and obstructing the orifice of the urethra, and sometimes the sensation of a body rolling about in the bladder.

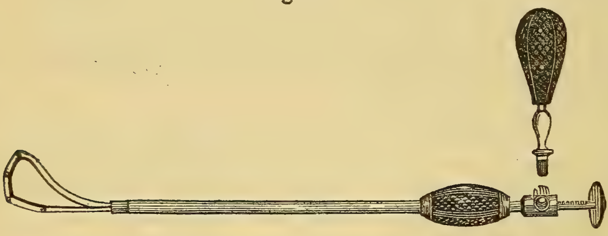
How may the existence of a stone in the bladder be demonstrated? —By sounding, by the introduction into the bladder of a steel sound.

Is it possible to dissolve a calculus in the bladder?—It is not; but the administration of alkalies or acids, according to the diathesis, will frequently prevent the increase of the calculus, and diminish the irritability of the bladder, and other painful symptoms.

How may calculi be removed from the bladder? — By crushing with lithotriptic and lithotritic instruments, and evacuating the fragments through the urethra; or by the operation of lithotomy, or sometimes, in females, by dilating the urethra.

What are the varieties of instruments now employed in lithotripsy, or the operation of breaking down a stone in the bladder?—Jacobson's instrument, (Fig. 214,) in which the stone is caught, as it were, in a

Fig. 214.

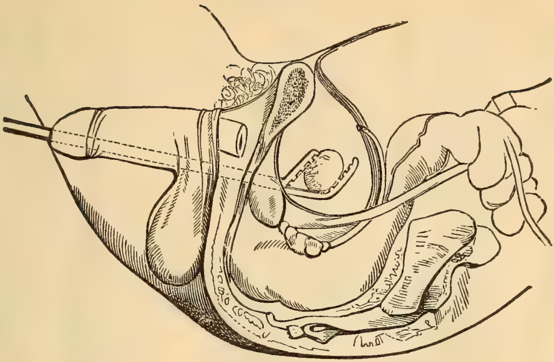


loop, and crushed; and Huerteloup's, (Fig. 215,) in which the stone is either crushed between the blades of the instrument, or broken by percussion with a hammer.

Fig. 215.

What precautions are necessary before the operations for lithotripsy or lithotomy are attempted? (Fig. 216.)—The patient should be prepared by low diet and perfect rest for some time before the operation; and the existence of a stone in the bladder should be previously positively ascertained by sounding the bladder, both when full and when empty, with a finger in the rectum to elevate the stone if necessary.

Fig. 216.



How is the operation of lithotripsy then performed?—The bladder having been previously dilated by the patient retaining his urine, or by an injection of tepid water, the instrument is introduced into the bladder, which is carefully explored until the heel of the instrument strikes the stone; the lithotripteur is then depressed alongside of the stone, its blades expanded, and the stone caught within its grasp, when the calculus may be crushed by closing the blades of the instrument, or by percussion.

What are the advantages of lithotripsy compared with lithotomy? Where the calculus is soft, lithotripsy presents by far the greatest advantages, in skilful hands; but where the operator is unskilful, it is more dangerous than lithotomy; and in cases of very large or hard calculi, it is altogether inefficient.

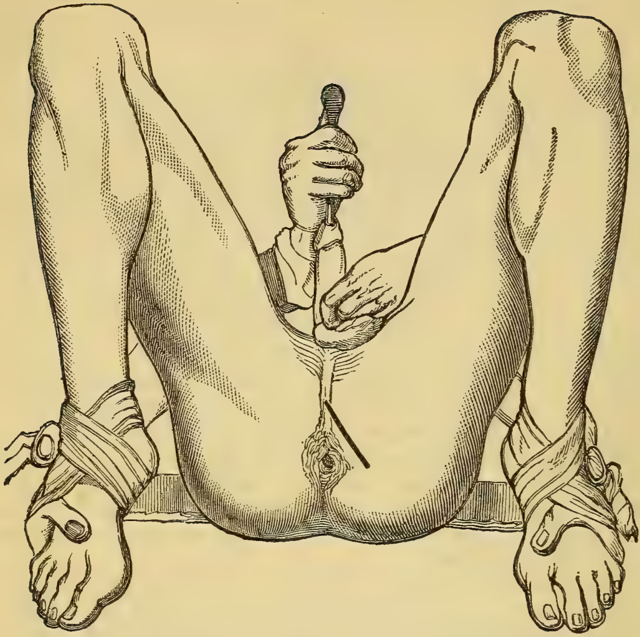
What are the two usual methods of performing lithotomy?—The high operation, in which the stone is removed by incisions through the parietes of the abdomen; and the lateral operation, in which the stone is removed by incisions in the perineum, through the left side of the prostate gland, and of the neck of the bladder,

Under what circumstances is the high operation justifiable?—When the pelvis is too narrow, or the stone too large to allow it to be extracted through the perineum; or when the prostate gland is too much diseased to admit of the lateral operation.

What precautions are necessary before performing the lateral operation of lithotomy?—The patient should be prepared by rest and restricted diet; the bowels and rectum should be emptied by purgatives and enemata; the hair should be shaved off from the perineum; and the bladder distended, by compelling the patient to retain his urine for two or three hours previous to the operation.

How should the patient be secured? (Fig. 217.)—He should be placed upon his back on a low table, with his hips and shoulders elevated, and his pelvis resting upon the edge of the table; a roller is

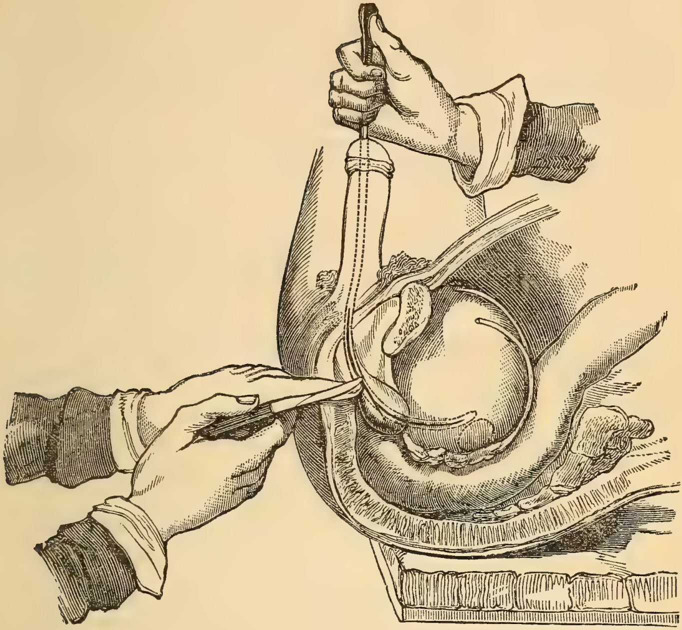
Fig. 217.



then fastened to each wrist, and while the patient grasps the soles of his feet, his hands and feet are securely fastened together by the rollers, and the patient's legs and thighs held firmly by assistants on each side.

How is the operation then performed? (Fig. 218.) — The surgeon, taking his seat in front of the patient on a low stool, introduces a staff, or sound, having a groove in its convexity, into the bladder; an assistant then holds the staff with one hand, and with the other raises the scrotum and testicles out of the way of the surgeon; an incision is then made with a scalpel, commencing opposite the under part of the arch of the pubis, and continued on the left side of the *raphe*, as far as a point midway between the tuberosity of the ischium and the anus, and dividing the skin, perineal fascia, transversus perinei muscle, the perineal branch of the internal pudic artery, and some of the fibres of the levator ani and accelerator urinæ; taking care to avoid wounding the rectum, by pressing it out of the way with a finger introduced per anum; an opening, an inch in length, should then be made through the membranous part of the urethra, cutting from below upwards into the groove of the staff; the surgeon then takes hold of the staff and depresses it, and introducing a beaked knife or cutting

Fig. 218.



gorget, with its beak in the groove of the staff, carries it forward through the prostate gland into the bladder, taking care not to wound the rectum; the finger is then passed into the bladder as the knife is withdrawn, and a forceps introduced along the finger as a guide, and the stone extracted.

What further treatment is required?—The hemorrhage should be arrested, and the bladder syringed, to clear it of all extraneous substances; the bandages should then be removed, and the patient kept upon his left side until the wound be healed—a very large gum catheter being interposed between the lips of the wound, to allow the urine to escape, and to prevent infiltration of the cellular tissue.

What are the objections to the cutting gorget generally used in this operation?—The danger of its wounding the pudic artery, or of being pushed through the bladder into the rectum.

What other method of performing lithotomy has been recommended?—To cut open and extract the stone through the coats of the rectum.

How may stone be extracted from the bladder of the female?—By dilating the urethra, or by incision.

How should lithotomy be performed upon the female?—The patient should be secured as in operating upon the male, and a straight staff passed into the urethra, and the urethra depressed; a straight bistoury is then passed along the staff, and carried obliquely downward through the urethra and neck of the bladder; or by dilating the urethra and dividing to a short distance on each side, and again dilating until the forceps can be introduced, and the stone extracted.

How may calculi be removed from the urethra? — By dilating the urethra, or by the urethral forceps of Sir Astley Cooper, or by the curett of Leroy D'Etiolle.

What are the symptoms of inflammation of the prostate gland?—Pain, heat, and heaviness of the rectum; difficulty of passing fæces and urine; great tenderness and enlargement of the gland, detected by introducing the finger *per anum*, and great pain on the introduction of the catheter.

What is the treatment proper in inflammation of the prostate? — General bleeding; leeches to the perineum, or within the rectum; opiate enemata; hip-baths, and abstinence.

What condition of the lining membrane of the prostate is sometimes excited by masturbation, or excessive venereal indulgence?—A granular condition, accompanied by involuntary emissions of semen, neuralgic pain, besides hypochondriac symptoms.

How may this condition be removed?—By passing nitrate of silver over the granular surface, by means of Lallemand's instrument, and the use of iodide of potassium.

How may chronic enlargement of the prostate be known? — By its occurring almost exclusively in old men, and by a sensation of weight in the anus, frequent and painful emission of urine, and great difficulty of passing the catheter; by the discharge of a ropy mucus, and by the tumour being felt by an examination *per anum*.

What are the remedies to be employed in this disease? — Mostly palliatory; as opiate injections, hip-baths, the introduction and retention of a large gum catheter; iodine, and the iodides of mercury and potassium have also been highly recommended.

What is meant by stricture of the urethra? — A partial or complete closure of the urethra from spasm of its muscles, or from thickening of its coats at some particular part, by inflammation and effusion of lymph.

How should spasmodic strictures be treated? — By opiate enemata, warm bath, antimonials, and bloodletting; or if nothing else will avail, puncture of the bladder.

At what part of the urethra are permanent or organic strictures generally situated? — Usually just behind its bulb, but frequently in other parts of the canal.

What are the symptoms of stricture of the urethra? — A difficulty in passing the urine, which issues in drops, or in a small twisted

stream; sometimes nocturnal emissions; and frequently chills and other febrile symptoms.

How may the situation and extent of a stricture be ascertained? — By passing a soft wax bougie into the urethra, observing the marks made upon it by the stricture; or by exploration by means of a silver ball at the extremity of a long wire, or by the graduated wedged bougie.

From what causes does permanent stricture arise? — Most frequently from repeated attacks of gonorrhœa; but occasionally from blows or injuries upon the part; or from the use of astringent injections.

How should incomplete closure of the urethra from stricture be treated? — By gradual dilatation with flexible or metallic bougies, introduced two or three times a day for several weeks, and gradually increased in size.

What caution is necessary in the passage of bougies or catheters? — Not to make use of violence, lest a false passage be formed by the point of the catheter or bougie entering one of the lacunæ in the urethra.

How should complete obstruction of the urethra be remedied? — A catheter should be carried down to the stricture, and the urethra divided through the strictured part by an incision in the direction of its length; and the catheter retained until the parts have united over it.

What are the objections to forcing the stricture with the conical sound, or by a stilet; or to removing it by the repeated application of caustic? — The first two methods are almost sure to produce lacerations and false passages; and the latter frequently produces severe constitutional symptoms, and is rarely successful.

What is fistula in perineo? — An external opening in the perineum, through which the urine passes, from a rupture or ulceration of the urethra.

How should fistula in perineo be treated? — A catheter should be passed into the bladder, through the urethra, to draw off the urine and allow the parts to heal; and if the fistula be caused by obliteration of the urethra, the strictured part should be divided as before recommended; and if the parts are not disposed to heal, the application of caustic or of a blister will sometimes be successful.

How should effusion of urine into the cellular tissue of the scrotum be treated? — By free incisions, and, in other respects, on the same principles as fistula in perineo.

What is phymosis? — An inability to retract the prepuce behind the glans penis; it being either congenital, or arising from inflammation.

How may it be relieved? — By circumcision or amputation of the extremity of the prepuce; or by slitting up the prepuce by means of

a bistoury and director; or by simply dividing the internal mucous membrane.

What caution is necessary in operating for phymosis?—The operation should not be performed when phymosis is complicated with chancre or gonorrhœa, lest the disease be communicated to the edges of the wound.

What is paraphymosis?—A strangulation of the glans penis by the retracted prepuce, owing to inflammation, or to a phymosed prepuce being forced behind the glans.

How should it be treated?—By cold washes, and antiphlogistics generally, or by slitting up the prepuce with a scissors or bistoury.

What is hydrocele?—A tumour of the scrotum, caused by accumulation of fluid in the cord, or in the cavity of the tunica vaginalis.

How does hydrocele of the cord generally occur?—In the form of an encysted oval tumour, situated midway between the testicle and the groin.

How may hydrocele of the tunica vaginalis be known?—By its beginning at the lower part of the scrotum and gradually ascending, assuming a pyriform shape; and by its being translucent, elastic, and imparting a sense of fluctuation to the fingers.

Fig. 219.

How may hydrocele be distinguished from sarcocele and from scrotal hernia?—By the pain, heaviness, and density in sarcocele; and by the impulse communicated to the hernial tumour by coughing.

What is the treatment usually employed for the cure of hydrocele? (Fig. 219.)—Evacuation of the fluid by tapping the tumour with a trocar and canula, and by injecting port-wine, or a solution of tannin, or tinct. of iodine into the sac.

What is hematocele?—An effusion of blood into the cavity of the tunica vaginalis, or into the cellular tissue of the scrotum.

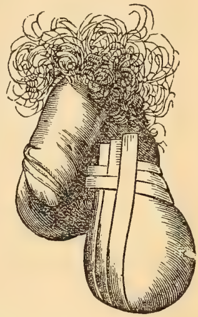
How should it be treated?—By rest in the recumbent position, astringent stimulating applications; or if putrefaction of the blood takes place, by free incisions and poultices.

What is orchitis, or hernia humoralis?—An inflammation of the testicle, indicated by pain and swelling of the testicle, pain in the back.

and in the lower part of the abdomen; with fever, nausea, and vomiting.

From what causes does orchitis arise? — From blows or other injuries, but more frequently from sudden repression of gonorrhœa.

Fig. 220.



How should this complaint be treated? — By supporting the testicles; by general and local bloodletting; cold lotions; or compression of the testicle by means of strips of the emplastrum ammoniacum cum hydrargyro, or of the emplastrum belladonnæ, alone, or with iodine, and sometimes by blisters, or simple adhesive plaster. (Fig. 220.)

DEFORMITIES.

STRABISMUS.

What is strabismus?—A squinting, or obliquity of the axes of one or both eyes, from contraction of the recti muscles.

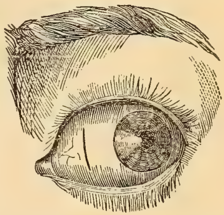
What are the varieties of strabismus? — Strabismus *convergens*, in which the eye is turned inwards; and strabismus *divergens*, in which the eye is turned toward the external angle of the orbit.

What are the causes of strabismus? — It sometimes is symptomatic of cerebral disease, but often proceeds from ophthalmia; or is congenital, of without any assignable cause.

What is the method of treatment? — When strabismus is symptomatic of cerebral disease, nothing can be done until the disease is cured; but idiopathic strabismus may in general be readily cured by division of the contracted muscle.

How is the operation performed? (Figs. 221, 222, 223, 224, 225, 226.) — The sound eye should be covered by a bandage, while one assistant steadies the head and elevates the upper lid of the patient, and another assistant depresses the lower lid, and fixes the eye by means of a double hook inserted into the substance of the sclerotic coat; the operator then pinches up a small fold of the conjunctiva at the inner or outer angle of the eye (according as the strabismus is *convergens* or *divergens*), and divides it with a knife or scissors; the sclerotic fascia should then be divided until the muscle is exposed; the muscle is then drawn forwards by means of a blunt hook passed behind it, and divided by a pair of curved scissors.

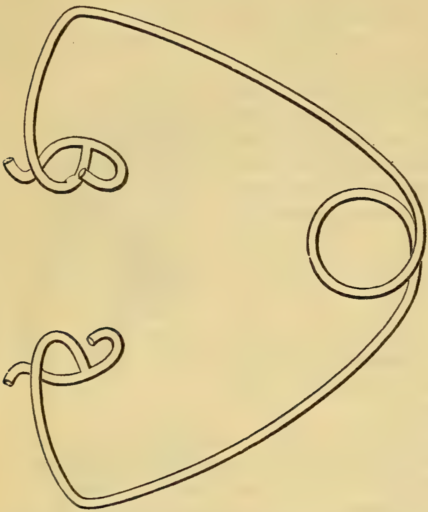
Fig. 221.



What caution is necessary in this operation? — The double hook

should be firmly fixed in the sclerotica, but not passed through it, lest the choroid membrane or retina be injured.

Fig. 222.

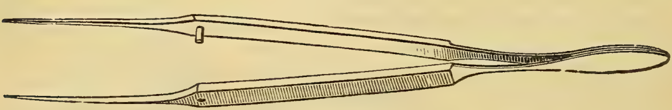


Is this operation attended with much hemorrhage?—The hemorrhage is very slight, and may be restrained by the application of cold water.

What is meant by rhinoplasty? (Figs. 227, 228, p. 378.)—The formation of a new nose by means of a flap from the forehead, or any other part.

How is the operation performed?—A piece of leather should be cut into the shape required, and, by means of it, the boundaries of the flap are marked upon the forehead, with the part corresponding with the apex and alæ of the nose upward; the flap should then be dissected up from the forehead, leaving an attachment at the root of the nose of some length, to allow

Fig. 223.



the flap to be twisted, so as to bring the epidermoid surface externally; the remaining edges of the former nose must then be pared down, and the flaps twisted and turned down, and kept in contact with the edges of the former nose by sutures, and a little oiled lint introduced into the nostrils to support the flap.

What caution is necessary in dissecting the flap from the forehead? The incisions should be carried deeply, so as to secure an abundant vascular supply, taking care to avoid the periosteum, lest exfoliation be excited.

How should the wound in the forehead be treated?—The edges should be brought together as nearly as possible, and the opening treated as an incised wound.

Fig. 224.

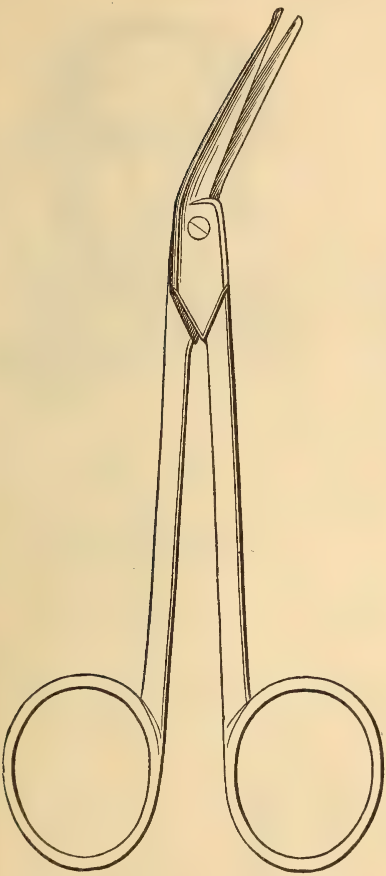


Fig. 225.

Fig. 226.

How may a loss of the columna, or of one of the alæ nasi be remedied? — By a flap, in the former case, from the upper lip, and in the latter case from the cheek.

Fig. 227.

Fig. 228.

Fig. 229.

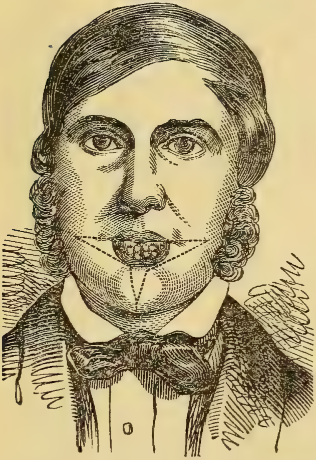
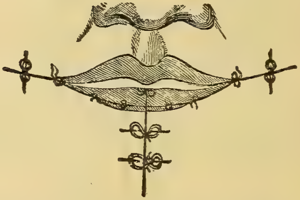


Fig. 230



What is cheiloplasty? (Figs. 229, 230.)—Restoration of a lip which has been destroyed, by means of a flap from the cheek.

How may hare-lip be remedied? (Figs. 231, 232.)—By paring away the edges and rounded corners on each side of the fissure, carefully adjusting the sides, and retaining them in contact by means of hare-lip pins and the twisted suture, until union takes place.

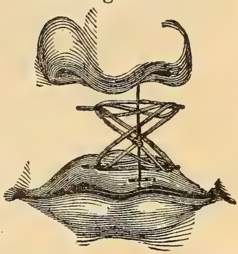
What is staphyloraphy?—An operation for the removal of fissure of the soft palate and uvula, by paring away the edges of the fissure, bringing the sides together, and retaining them in contact by sutures passed by means of curved needles or instruments contrived for the purpose.

What is torticollis?—A distortion of the neck from contraction of the sterno-cleido-mastoid muscle, or from curvature of the cervical vertebræ, or from paralysis of the muscles of one side.

Fig. 231.

How may this deformity be removed?—When it arises from paralysis, or from disease of the bones, there is little or no hope of a cure; but wry-neck from contraction of the sterno-cleido-mastoid may be removed by section of the muscle.

Fig. 232.



How is this performed?—The patient's head should be inclined towards the affected side so as to relax the contracted muscle, which should then be lifted up, together with the skin covering it, and the muscle divided at its upper or lower extremity, by a bistoury passed through a puncture in the skin.

What are the causes of club-foot?—It is generally congenital, but is sometimes produced by sprains, dislocations, or other injuries.

In what does it consist?—In deformity, or partial luxation of the bones of the tarsus, with contraction of some muscles and ligaments, and relaxation of others.

What are the varieties of club-foot? (Figs. 233, 234, 235, 236.)—

Fig. 233.

Fig. 234.

Fig. 235.

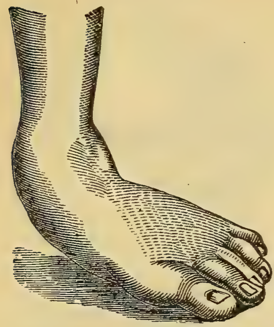
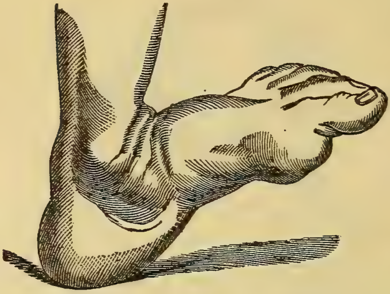


Fig. 236.

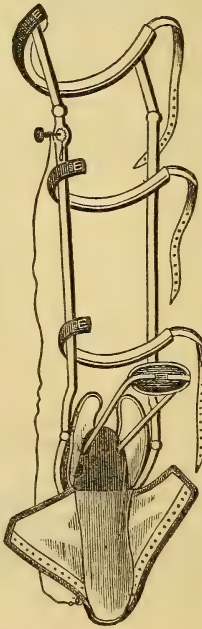


Varus, or inverted club-foot, in which the patient walks upon the outer ankle; *valgus,* or the everted form, in which the patient treads upon the internal margin of the foot; the *phalangeal* form, or *pes equinis,* in which the heel is drawn up from the ground; and the *calcaneal* form, in which the toes are drawn upwards toward the anterior surface of the leg, and the patient walks upon the heel.

How should club-foot be remedied? (Figs. 237, 238.)—The foot

Fig. 237.

Fig. 238.



should be gradually drawn into its natural position by appropriate machinery; or if this be impracticable, the contracted tendons should be divided subcutaneously, and the foot then placed in the machine and gradually extended.

AMPUTATION.

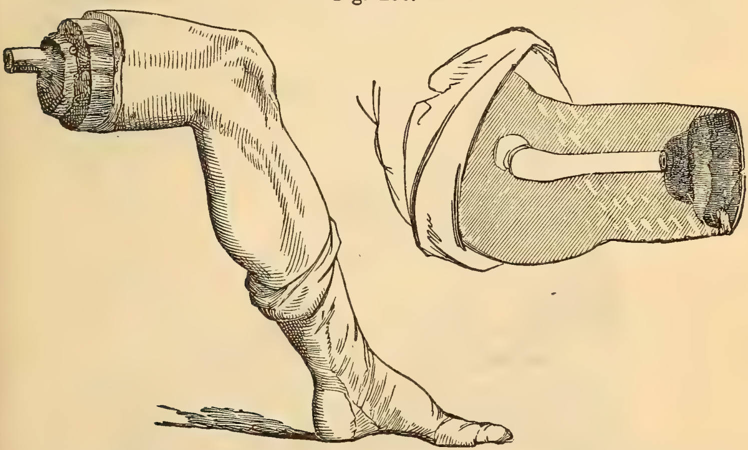
What is amputation?—The operation of cutting off a limb, or a projecting part of the body; as the leg, the mamma, or the penis.

What are the cases requiring amputation?—Gunshot or other fractures, with extensive injury of the soft parts, or of the principal artery of a limb, or involving joints, rendering the patient's recovery improbable, unless amputation be performed; malignant tumours, especially of the joints; chronic gangrene; or ulcers threatening to exhaust the patient by their continual drain from the system.

What is the difference between *primary* or immediate, and *secondary* amputation?—*Primary* amputation is that which is performed soon after reaction has taken place; *secondary* amputation is that in which the operation is delayed until after suppuration has occurred.

What are the cautions with regard to the time of performing amputation?—Amputation should never be performed after an injury until

Fig. 239.



reaction has taken place; and the primary operation is always to be preferred to the secondary; as the neighbouring joints and soft parts may become involved in the inflammation that follows reaction.

What delay is necessary if mortification has already taken place?—The operation should not be attempted until the disease is arrested; otherwise mortification of the stump will ensue.

What are the two methods of amputating limbs? (Fig. 239.)—The circular and the flap operation.

How is the circular operation performed? — The circulation of the blood is interrupted by surrounding the limb with a tourniquet, having its pad fixed over the course of the main artery; the skin and fascia are then divided by a circular cut with the amputation knife, and afterwards dissected up for two or three inches, and turned back; the muscles are next divided down to the bone by the amputation knife, in such a way as to give the stump the form of a hollow cone; the muscles are now separated from the bone, for a short distance, by the scalpel, and drawn back by means of a retractor, or by the hands of an assistant; the bone sawed through, and the spicula removed by the bone nippers; the arteries are then to be tied; taking care to avoid inclosing the nerves in the ligature; the stump sponged with warm water to remove the coagula; the muscles and integuments must be brought together over the bone, and retained by sutures and adhesive strips, leaving the ligatures hanging out at a dependent part of the stump.

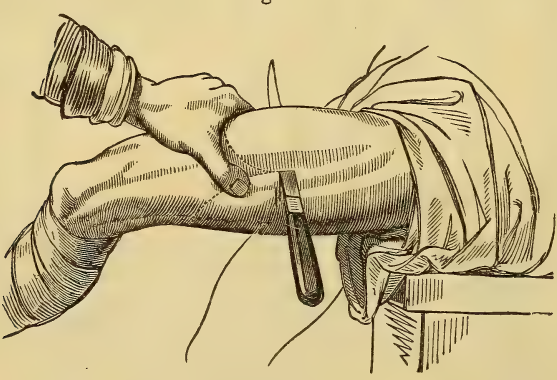
What additional dressings are employed?—A square piece of linen or cotton, covered with cerate, is placed over the adhesive strips, and over this a Maltese cross, formed of linen or cotton; and the whole enveloped in a roller, and the tourniquet loosely encircling the limb, so as to be ready in case of secondary hemorrhage.

How long should the dressings remain before they are opened? — In winter, five or six days; in summer, they should be opened, and re-applied at least every three days. [1]

What advantages does the flap operation possess over the circular? — It is more speedily performed, less painful, and provides a better covering for the stump, so as to relieve the pressure upon the extremity of the bone; and the wound generally unites by the first intention.

How does the flap operation differ from the circular? (Fig 240.)—

Fig. 240.



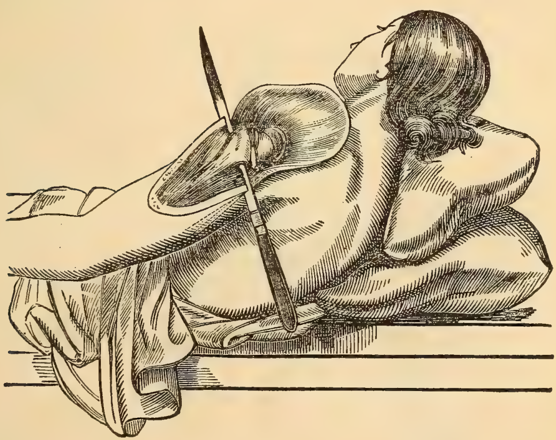
[1] Mr. Liston never applies any compresses, rollers, or other dressings to the stump over the adhesive strips, unless suppuration takes place.

Instead of dividing the skin and muscles successively by circular cuts, one or two flaps, according to circumstances, are made, either by cutting from without inwards, or more generally by taking hold of the soft parts on the anterior side of the bone, and lifting them from it, while a catling, or narrow double-edged knife, is passed horizontally through the integuments and muscles immediately above the bone, bringing out the point as low as possible, and then cutting the knife outward in such a way as to form a rounded flap anteriorly; the knife is again entered behind the bone, a little below the top of the first incision, passed through the limb horizontally, and cut out so as to form a posterior flap; the flaps should then be retracted; the muscles enveloping the bone divided; the bone sawed; the arteries tied, and the flaps brought together and retained by sutures and adhesive strips, as in the circular operation.

How may the operation be varied where it is desirable to save as much blood as possible? — The limb may be elevated for some time before the operation, so as to drain the blood as much as possible; and compression should be made upon the main arterial trunk by the thumbs of an assistant, without hindering the return of the blood through the veins.

How is amputation at the shoulder-joint performed? (Fig. 241.)—

Fig. 241.



The subclavian artery is first compressed above the clavicle where it crosses the first rib, by means of the handle of a key, covered with linen or cotton; and one or two flaps, according to circumstances, are to be made by transfixion, or by cutting from the surface toward th

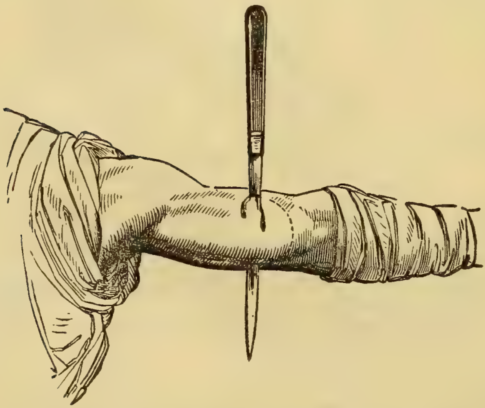
bone; the joint being cut through after the formation of the first flap, and the second flap then formed, the arteries secured, and the stump dressed.

Fig. 242.

How is amputation of the arm or forearm performed? (Figs. 242, 243.)—In the former case by the circular or double flap operation; compression being made in both cases by a tourniquet (or by the thumbs of an assistant), upon the brachial artery at the inner edge of the biceps muscle.

How is amputation at the wrist performed? (Fig. 244.)—A semilunar incision is made through the integuments over the second row of carpal bones; this flap is then pulled back, the joint opened, and the ligaments divided, and a second longer flap made below, bringing the knife out at the palm; compression being made in the same way as in amputation of the arm.

Fig. 243.

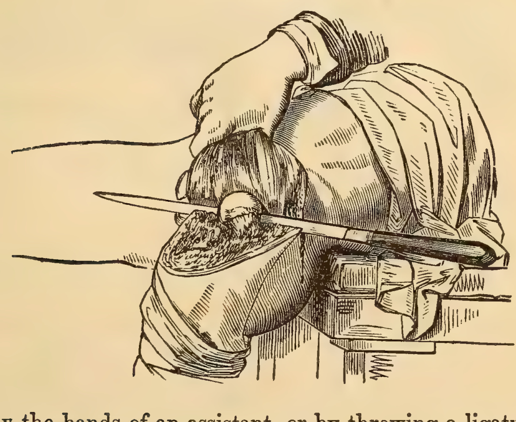


How may the fingers and thumb be amputated?—By the circular operation; or by the formation of a flap; and cutting through the joint instead of sawing through the phalanges.

Fig. 244.

How is amputation performed at the hip-joint? (Fig. 245. — The patient is to be secured on a table, with his hip near the edge: the femoral artery is first to be compressed where it comes out of the pelvis

Fig. 245.



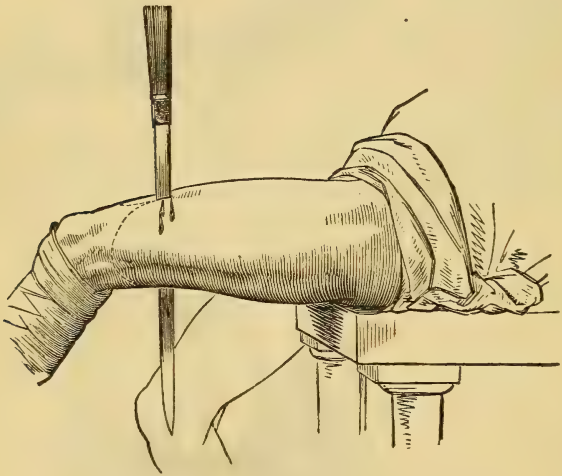
(either by the hands of an assistant, or by throwing a ligature around it at that place); the limb is then slightly elevated, and the catling passed through the limb in front of the bone, its point entering midway between the anterior superior spinous process of the ilium and the trochanter major, and emerging on the opposite side, two or three

inches from the anus; the knife should then be carried downwards and forwards, so as to form an anterior flap four inches long; this flap should be elevated, and the capsular and round ligaments of the joint divided, depressing the thigh at the same time, so as to cause the head of the bone to start from its socket; the knife should then be passed behind the head of the bone, and carried downwards and backwards, so as to make a posterior flap somewhat longer than the anterior; the arteries are then to be secured, and the stump dressed as in other cases.

What is the result of this operation? — The operation is in most cases fatal; and should never be performed but as a last resource.

How should amputation of the thigh be performed? (Fig. 246.)— By horizontal transfixion, so as to make anterior and posterior flaps

Fig. 246.



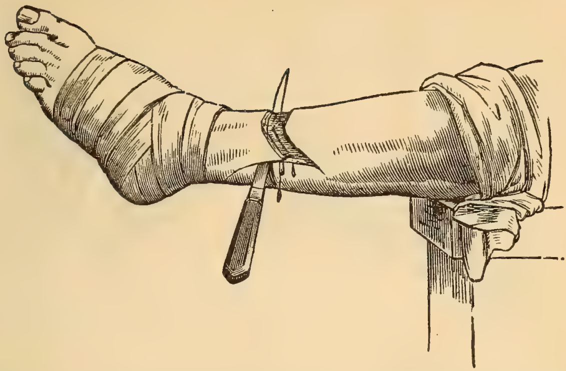
when the operation is performed at the upper or middle third of the limb; and by Vermale's operation, or with lateral flaps, when amputation is in the lower third.

What part of the thigh is most favourable for the performance of amputation? — A point near to, and not below, its middle.

How is the leg usually amputated? (Fig. 247.) — By the circular operation, or with a posterior flap; cutting through the bones, two or three inches below the tubercle of the head of the tibia.

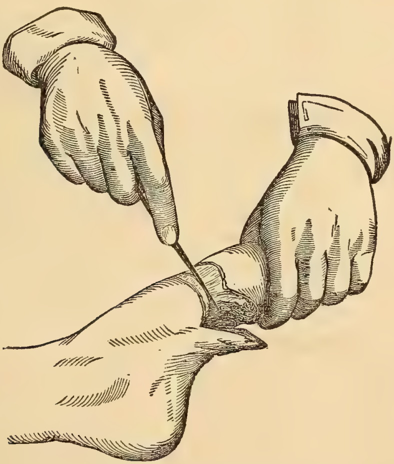
What is the objection to leaving a long stump in amputation of the leg? — It is inconvenient, from its projecting so far out behind, when bent at the knee, and is not well adapted to the patient's wearing a wooden leg.

Fig. 247.



Where is the foot generally amputated? (Figs. 248, 249.)—Either by Hey's operation, at the junction of the tarsal and metatarsal bones;

Fig. 248.

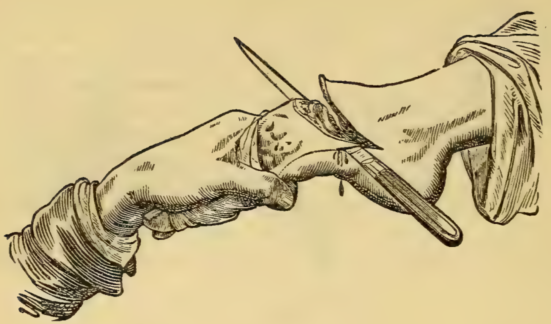


or by Chopart's, at the junction of the ossa calcis and cuboides, and the astragalus and scaphoides.

What is the most important precaution in these amputations?—To se ure flaps of sufficient size to cover the stump.

What is the principal objection to the operation of Chopart?—

Fig. 249.



It is generally followed by retraction of the os calcis, throwing the weight of the body upon the cicatrix and anterior ends of the bones.

How may amputation of the metatarsal bones and phalanges of the toes be performed?—Upon the same principles as amputations of the metacarpal bones and phalanges of the fingers.

What precaution should be observed in amputation of the metatarsal bones of the great toe? — The head of the bone should be preserved, if possible, as it gives attachment to the peroneus longus.

For what is amputation of the breast demanded? — For carcinoma or cancer of the part, or for very great enlargement.

How is the operation performed? — By making two semicircular incisions, in a direction nearly vertical, including the diseased part between them, and meeting at their points, taking care to cut down to the pectoral muscle; the skin and cellular tissue included between the incisions should then be carefully dissected up; the surgeon compressing the arteries as they are divided, and removing any enlarged gland with its absorbents and intervening cellular tissue; the arteries are then to be secured, and the edges of the wound brought together and retained in contact by sutures, adhesive strips, and bandages.

What circumstances render it inexpedient to perform this operation? — The existence of several enlarged glands in the axilla, indicating that the disease is beyond the reach of the knife.

How should the penis be amputated?—The penis should be grasped in the left hand, and divided by a single cut of the knife, while an assistant, making pressure at the root of the penis, commands the hemorrhage until the arteries are picked out and tied.

What precaution is necessary during the healing of the wound? — To prevent (by the introduction of bougies), the obliteration of the orifice of the urethra.

THE USE OF ETHER AND CHLOROFORM IN SURGERY.

What great agents have been discovered by which a patient undergoing an operation may be rendered unconscious of pain? — The anæsthetic, such as chloroform, or anhydrous sulphuric ether.

How are they administered?—The most common and simplest way is upon a sponge, or a towel rolled up in the form of a trumpet, the preparation being poured into the convexity in different quantities, according to the susceptibilities of the patient and the necessities of the case.

Are they used alone or separately? — By some surgeons, they are used entirely uncombined; by others, the chloroform is used in combination with the ether or letheon, in the proportion of one part chloroform to two, three, or four parts ether.

What general rules are necessary to observe in the use of the anæsthetics? — First, as regards the class of patients. It would be injudicious to use them where they are subjects of phthisis, any of the diseases of the heart, or where there is a tendency to excessive plethora, or fulness about the head. Besides, if used soon after a meal, the patient is liable to excessive vomiting. Second, as regards the quantity administered, and the effects upon the patient. In regard to quantity, this varies according to the anæsthetic used. If it is chloroform, the quantity is smaller in proportion than when ether is administered. Besides, chloroform is more dangerous than ether under any circumstances. The quantity of either varies according to the susceptibilities of the patient. When either are administered, the condition of the pulse, the action of the heart, and the state of respiration, should be watched. If the pulse flags, becomes feeble or jerking, or irregular, and the heart's action trembling and irregular or tumultuous, and the respiration stertorous, or we have snowing, and the head becomes turgid and florid, we must cease at once. The patient should be directed to take full and deep inspirations, and the sponge or towel should be gradually approached to the mouth and nostrils; the eyes should be closed, and the apartment kept quiet, so so as to prevent the diversion of the mind; and when the patient evinces signs of being under its influence, he should be directed to open the eyes, or a pinch may be given, which, if the patient heeds not, you may commence the operation.

In case of any dangerous symptoms arising, notwithstanding your caution, what would be the proper plan to give relief? — If there should be a state of syncopy, or apparent failure of the vital powers, withdraw the anæsthetic at once; throw open the windows, draw the tongue forward by a forceps or fingers; do not place the patient on his back; apply external stimulants, and pass an open bottle of spirits of ammonia before the nostrils; dash cold water on the chest or face, imitate the respiratory movements of the chest and abdomen, apply warmth to the extremities, and sometimes use the galvanic battery in

gentle currents from the nape of the neck to the diaphragm. If there should be symptoms of congestion of the brain, the remedies usual in such cases should be used.

What is the relative danger in the use of ether and chloroform?—There are numerous cases mentioned, both in this country and in Europe, where fatal results have followed the use of chloroform, *alone.* This is not so in regard to ether; very few, if any, have ever occurred after its use, or where a small amount of chloroform has been added to the ether, to bring the patient more speedily under its influence. Although both of the above are great alleviators of human suffering, they should never be used for trifling operations, or any operation about the throat, as the patient may strangle before the effects of the anæsthetic can be overcome.

PART IV.

PRACTICE OF MEDICINE.

FEVER.

What do you understand by a fever? — A state of the system following languor, weakness, and defective appetite, with acceleration of the pulse, increased heat, great debility of limbs, and disturbance of most of the functions, with or without primary local disease; or "painful lassitude with debility of the corporeal and mental faculties; alteration of the animal heat, and of the secreting functions; accelerated circulation, increased thirst, and abolition of the appetites."—[Copland's *Dictionary.*]

How may fevers be divided? — Into primary and secondary.

What do you mean by these terms? — The first, where the local disease is consequent upon the fever; the second, where the fever is consequent upon local disease.

How do you divide primary fevers?—Into ephemeral, intermittent, remittent, continued, eruptive, and arthritic.

What is the most simple variety of primary fever? — The epheme ral, or that which lasts but a day, passing off without any bad consequences, and requiring but very slight treatment.

INTERMITTENT FEVER.

What do you understand by an intermittent fever? — A succession of periodical paroxysms of fever, each paroxysm commencing with chills, and terminating in free perspiration, with protracted intervals of perfect freedom from fever.

How are intermittents generally divided? — Into quotidians, or paroxysms every day; tertians, or paroxysms every other day; quartans, or paroxysms every fourth day; quintans, or paroxysms every fifth day. These types may be modified.

What are some of the premonitory symptoms of an intermittent?

— Great lassitude, frequent yawning and stretching, uncomfortable weariness of the whole body, and aching in the loins and extremities, generally lasting from two to ten days, when the characteristic paroxysms show themselves.

How is each paroxysm divided? — Into three marked stages, viz.: the cold, the hot, and the sweating.

What are the characteristics of the cold stage? — Sense of chilliness, with feelings of languor, cold hands and feet, with chilliness down the back, accompanied with headache, and a bluish tint to the nails, the patient sits crowded upon himself, his ideas pass rapidly through the mind, and the attention is with difficulty fixed.

What is the condition of the præcordia, appetite, pulse, countenance, and respiration? — There is much oppression about the præcordia; the appetite is squeamish; the pulse loses its activity and size, and becomes small, contracted, frequent, and firm; the countenance is parched, features shrunk, the eye dull and hollow, and cheeks livid and collapsed; the respiration is hurried, anxious, and oppressed; there are some in whom drowsiness, if not deep coma, exists, as in those of debilitated constitutions, especially if there is any tendency to plethora.

What is the condition of the urine and fæces? — The urine is copious, clear, colourless, and does not deposit a sediment on cooling; the fæces are dark and bilious.

How long does this stage generally last? — From half an hour to four hours.

Does this stage of fever ever remain without reaction?—Yes; and then the patient is in imminent danger.

When does the hot stage take place? — It immediately follows the cold, without any distinct interval.

What is now the condition of the patient? — The countenance is flushed and turgid; the surface of the body is dry, and the temperature is raised above the natural standard, 105° 110° Fahrenheit; the mouth is dry and parched, and the thirst great; the pulse is full, strong, and free; the respiration is hurried and oppressed; the urine is scanty and light-coloured; and sometimes the patient experiences great pain in his head, thorax, left hypochondrium, and extremities, and delirium sometimes supervenes just before the commencement of the succeeding stage.

How long does the hot stage last? — From three to twelve hours.

Describe the state of the patient in the sweating stage? — The pulse is full, but without harshness and frequency; the respiration is free and natural; the urine is high-coloured, and deposits a lateritious sediment; the bowels are more readily acted upon; the mind is more composed; and the other symptoms also abate; this continues from three to four hours.

What is the condition of the patient after a paroxysm? —He is

enabled frequently to return to his duties, though a feeling of lassitude and weakness still exists.

What is the interval between the paroxysms called? — Apyrexia, or intermission.

Is he free from disease during this period? — No; his countenance is sickly, and the mental and bodily powers are excited with difficulty, the appetite is bad, and the digestion is carried on indifferently.

What is the first variety of intermittent fever? — The quotidian; characterized by the intermission occurring every twenty-four hours.

What is the peculiarity of this type? — The intermission being short and the paroxysm long, and the paroxysms occurring generally in the morning.

How is a paroxysm of quotidian ushered in? — Generally by slight chilliness, and inconsiderable gastric derangement, and generally lasts three hours.

How is the hot stage characterized? — By thirst and general warmth, rather than great heat, and the pulse being quick, but not hard, and lasts for two hours or more, and then a slight perspiration supervenes.

How long does the paroxysm last? — From ten to twelve hours.

How long does the intermission last? — From twelve to fourteen hours, but in bad cases not more than six.

By what circumstances is the continuance of quotidian fever modified? — By age, constitution, and season of the year, the fall and spring being the worst; and those constitutions of weak and lax fibre are peculiarly obnoxious to it.

Does one paroxysm ever run into another? — Yes.

What is an anticipating quotidian? — One where the paroxysm sets in two hours or more before the usual time.

What is a retarding quotidian? —It is the counterpart of the anticipating.

What is the next variety? — The tertian.

By what is it characterized? — By the paroxysm commencing every forty-eight hours, and by its being the most frequent variety of all the types.

When do the paroxysms begin? — Generally about noon, and last on an average about six hours.

What are some of the premonitory symptoms? — An overwhelming languor, continued yawning, creeping sensation over the surface, coldness down the back, and the rigor being very intense, much nausea is present, and the general and lumbar pains are great; this stage lasts not more than an hour.

How long does the hot stage last? — It is disproportionately long; it may continue for three hours.

Are there any symptoms peculiar to this stage, and differing from that of other agues? — No.

Is the apyrexia marked by any unpleasant symptoms?—Yes; there is much weakness and loss of appetite.

Which is the least dangerous of the several types? — The tertian.

Is this form ever complicated with any chronic diseases? — Yes; those of the stomach, liver, and spleen.

What are some of the irregularities of this type? — They become double, and sometimes triple tertians.

What is a double tertian? — One in which the paroxysm takes place daily, so that two fits and two intermissions occur in the forty-eight hours, and hence similate the quotidian.

In what does it differ? — By the paroxysm not occurring in the morning, but more particularly in the alternate ones being similar, while those which follow each other are not so.

What are some of the irregularities of the double tertian? — The cold stage is simply a rigor, and then after an hour or two great heat follows, and continues for an uncertain number of hours.

What is the condition of the irregular paroxysm? — The termination is more confused and incomplete than the severe paroxysm of the previous or following day.

At the completion of the fit are there any distressing symptoms remaining? — Yes; acute pain in the chest and stomach, diarrhœa, and partial suppression of urine.

Are there any peculiar symptoms in the hot stage? — Yes; palpitations of the heart, cough, vomiting, and hemorrhage from the nose.

Do many of the symptoms remain after the completion of the paroxysm? — Yes; and thereby create much confusion in the course of the disease.

What are the durations of the paroxysms? — They are very uncertain, having lasted in some instances from ten to twenty hours without any solution.

What is the triple tertian?—One where there are three paroxysms and three intermissions in forty-eight hours.

What is a quartan ague? — Where an intermission commences every seventy-two hours.

How long does the paroxysm last? — From five to nine hours, and commences generally between 2 and 5 P. M.

Are there any circumstances peculiar to this type? — No; except the cold stage, lasting from two to three hours.

When does this variety usually occur? — In the autumn.

Who are more liable to it? — The old and melancholic.

Is it difficult of cure? — Yes; the most difficult of all the types, but s not often fatal.

What are the varieties of this type? — Double quartans, triple quartans, and the duplicated quartan.

Do these differ in their general characters from the same varieties of tertian? — No.

What are the cold, burning, and sweating agues? — Deviations from the autumnal tertian, and are attended with danger.

What are complicated agues? — Where one type is converted into another.

What are the modifications of intermittent fever? — 1, The inflammatory; 2, the congestive; 3, the malignant.

What are the characteristics of inflammatory intermittent? — By the intermissions not being free from febrile symptoms, the rigors being strong and attended with vomiting, and the paroxysms protracted.

Which types of the disease are more likely to assume this character? — The quotidians and tertians.

What are the peculiarities of the congestive varieties? — The cold stage is protracted; the vertigo and pain in the head great; the pulse is small and weak; the hot stage is badly developed, and the system oppressed during its whole course; the sweating stage is badly developed; the countenance during the intermission, is pale and contracted; the surface of the body is colder than usual; while the feeling of the interior of the body is that of intense burning.

Does this form of ague frequently occur? — No.

Who are most liable to it?—Persons of debilitated habit of body, among whom it is very fatal.

Where are malignant intermittents most frequently found?—In hot climates.

What persons are most liable to them? — Those of broken down constitutions.

How are they characterized? — After the second, third, or fourth paroxysm, the cold stage is either shorter and intense, or else much prolonged.

During the hot stage, is there anything peculiar? — Yes; instead of the usual phenomena, urgent symptoms of a very deleterious character appear, as fœtid perspiration, colliquative hemorrhage, and petechiæ.

After which paroxysm does death generally supervene?—The third.

What are some of the complications of intermittent fever? — Gastric, cerebral, pulmonary, cardiac, splenic, icteric, &c.

Which is the most frequent? — Gastric.

When do these symptoms supervene?—After a short shivering fit, at the commencement of the hot stage.

When the liver partakes in the morbid action, what is the character of the discharges?—Those of broken-down flesh, or dark blood partly coagulated.

What is the general condition of the patient?—The prostration is extreme and dangerous.

What are the peculiarities of the cerebral complication? — Lancinating pain is felt in the frontal region, with impaired vision, and great sensibility to light, and, in short, those of meningitis.

When does coma supervene? — At the end of the cold and beginning of the hot stage.

When there is pulmonary or cardiac complication, do the symptoms differ in any marked degree from those of ordinary pectoral affections? — No.

Is this a dangerous complication? — Yes.

What change takes place in the spleen?—It becomes enlarged, and bears the name of *ague cake.*

Are the nerves ever affected in an intermittent character? — Yes; the *tic douloureux* or neuralgia often takes on a periodical character, and the other neuralgias are similarly influenced.

With what fevers may intermittent be confounded? — With remittent and hectic fever.

How does it differ from the remittent and hectic? — In remittent fever the apyrexia is never complete, or the cold and sweating stages decided. In the hectic the accession takes place daily and in the afternoon, and the pulse continues small and rapid during the intermission.

What is the prognosis of intermittent fever? — In temperate climates the prognosis is favourable; in hot latitudes, however, it sometimes assumes a highly unfavourable character.

When death does take place, however, in the milder state, during what stage does it generally occur? — The cold, with symptoms of congestion.

In what class of persons is death most liable to occur? — In the feeble, nervous, and those of broken-down constitutions.

What variety of intermittents are the most difficult to cure?—Those of irregular type and phenomena.

Which are the more favourable, postponing or anticipating agues? —Postponing.

What are some of the favourable and unfavourable indications in intermittents? — Scabby and humid eruptions about the mouth, and reappearance of suppressed discharges are favourable, while indigestion, delirium, difficult and oppressed breathing, with sighing and singultus, bloody urine, colliquative diarrhœa, &c., are unfavourable.

Which of the types are more susceptible of cure? — Tertians and quotidians.

Do intermittents ever change to remittents? — Yes.

How do intermittents generally terminate? — Quotidians appear to complete their course, when they are not embarrassed in any way, by the seventh day, tertians on the fourteenth, and quartans generally run to the sixth week.

Are autumnal intermittents ever superseded by vernal? —Yes.

Do they ever terminate unfavourably? — Yes; when some organ is prominently effected, which thereby deranges the general health of the patient.

When does death generally ensue? — When the severity of the

general disease overwhelms the vital powers, or when these are worn out by the effects of some local lesion.

Anatomical Characters.

Do pathological investigations throw any light upon the essence of intermittent fever? — No.

In cases of some standing, are not the internal organs affected? — Yes; we find the brain, its arachnoid membrane and substance, implicated; we have also gastro-enteritis, gastritis, the spleen softened and enlarged, hypertrophied and indurated, and ruptured; liver softened; gall-bladder affected.

Are the thoracic organs ever affected? — Yes; we sometimes have pericarditis, pneumonia, &c.

Are we acquainted with the laws that regulate the periodical recurrence of ague? — No.

Does age have any influence upon the type of the disease? — Yes; the quotidian is generally in early life or advanced age; the tertian in adult; and the quartans in the adult and aged.

Does climate and season have any influence? — Yes; there is a marked difference between the agues of hot and cold climates, and the autumnal intermittents are more resisting than the vernal.

What are the exciting causes of this disease? — Marsh miasm, or paludal exhalation, have generally been conceded as the cause, but these have lately been doubted.

Are there any other causes? — Worms, intestinal irritation, fright, suppressed catamenia, &c.

Treatment.

What is the first thing that should be attended to in the treatment? The removal of the patient from malarious influence.

How do you divide the treatment? — That necessary during the paroxysm, and that during the interval, and that proper to the sequelæ.

Is there, as a general rule, anything necessary to be done during the cold stage? — Not unless it should be long and violent, or a tendency to prostration, when warm diluent drinks may be administered, and warmth applied to the external surface, while sometimes opium quiets the pain and convulsive shaking.

What are the remedies which have been given to curtail the cold stage? — Emetics and opiates; bleeding has also been recommended in cases where the constitution was vigorous, tourniquets around the extremities, &c.

When the hot stage arrives, how would you treat your patient? — Let the clothing be light, apartments cool, body sponged, and acidulated drinks administered, or the neutral mixture.

Should there be symptoms of organic disease supervening, would there be any necessity for more decided treatment? — Yes; abstrac-

tion of blood locally, by leeches or cups, or general bloodletting may be resorted to, together with blisters and other counter-irritants.

When the hot stage has subsided, what is necessary to be done?—Favour the sweating stage by the usual diaphoretics, viz., neutral mixture, warm teas, &c.

If, however, this stage should weaken the patient, what should you do? — Dry sponge the body, and replace the wet by dry clothes, and administer a gentle cordial.

What is necessary to be done in the decidedly inflammatory type? Venesection, purging, and the general plan of treatment proper in continued fever, regarding the type of the disease, and the intensity of any local affection.

Should there exist any gastric symptoms how would you treat them? —By leeches, mild aperients, sinapisms, effervescing mixture, and opium combined with aromatics.

If the ague is complicated with dysenteric symptoms, what must be done? — If the stools are bloody or slimy, with tormina, opiates and mild aperients will be proper, and it may be necessary to take blood from the arm, or locally; or warm fomentations may be used, over the abdomen.

In the congestive malignant or pernicious variety, can we ever wait to prepare the system? — No; but must immediately resort to tonics and stimulants.

What should be given in the cold stage? — Bark, hot negus and laudanum, and hot drinks to bring on reaction.

What is proper in the hot stage? — Diaphoretics and antispasmodics, the warm bath, &c.

What should be done in the sweating stage? — It should be promoted by opium in combination with other diaphoretics.

If there is much debility, what should be done? — Give stimulants, as camphor and ammonia, brandy toddy, quinia, &c.

What should be done during the intermission of the paroxysms?—The most strenuous means to prevent the recurrence of the paroxysm should be used.

What are the indications during an intermission in any of the types? — To cleanse the system, and correct any co-existing organic disease, and prevent a return.

What are some of the remedies? — Emetics, as tart. ant. et potas., Fowler's mineral solution, zinci sulph., absinthium, acetate and citrate of ammonia, salicene, &c.

Which, however, are the more decided remedies? — *Chinchona and its preparations.*

What is the best preparation? — The sulphate of quinia.

Is there any determined mode of giving the sulphate? — No; practitioners generally suit their own predilections. Large doses, frequently repeated in the interval of the paroxysms, has many advocates.

In malignant intermittents must the quinia be largely administered? Yes; and in frequent doses.

Is there any unpleasant consequence from the administration of quinia in too large doses? — Yes; there are sometimes violent cerebral symptoms, which, however, may soon be overcome by withholding the medicine, and using the ordinary means for cephalic disturbance.

What are some of the sequelæ of this fever? — Œdema of the feet and legs, enlargement of the liver and spleen, jaundice, dropsy, general cachexia, and dysentery.

What are some of the remedies best adapted to this state of things? — Local depletion, mercurialization; and mineral acids and tonics in general cachexia.

What would you do in enlargement of the spleen? — Administer quinia and iron, and sometimes some of the preparations of iodine, muriate of ammonia, and counter-irritants.

In dropsy, what is necessary? — Cure the original seat of the disease and cause of the dropsy, if possible.

In cases of relapse, what is sometimes necessary to be done? — To produce gentle ptyalism and guard the patient from all exciting causes.

REMITTENT FEVER.

What do you mean by a remittent fever? — It is that form of fever in which there are regular exacerbations and remissions of the paroxysm in the twenty-four hours.

What place does this fever occupy? — A middle ground between the intermittent and continued.

Do the symptoms of the forming stage of remittent fever differ in any marked degree from those in intermittent fever? — No.

Are there any peculiar symptoms? — There is great sensation of weight, languor, aching in the head, back, and extremities; the bowels are inactive, or the discharges are mixed with bile; with an unpleasant metallic taste in the mouth; skin sallow, &c.

When the disease is fully established, what do you find? — Aggravation of all the preceding symptoms, tenderness of the epigastrium and right hypochondrium, the surface of the body dry and above the natural standard of heat; a flushed and excited system; the eye is slightly tinged and restless, the pulse is frequent, small, and irregular, and then full and forcible; the mouth and fauces are dry and clammy; the tongue furred, white, and sometimes brown; the respiration is hurried and oppressed, and there is nausea, and sometimes vomiting of bilious matter; the excretions from the bowels are black or green, while the urine is scanty and tinged with bile.

How long do these symptoms continue? — From five to ten hours, when a gentle perspiration breaks out, with a decline of all of them.

Do these symptoms generally entirely subside? — No; the skin is still preternaturally warm, and the pulse irritated.

How long does the remission generally last? — From two to four hours, when another paroxysm arises of equal or greater intensity, and thus continues till either convalescence or death ensues.

Does this fever ever put on a very serious aspect? — Yes; there is a great diversity in its general characteristics, happening in various situations, and under various circumstances.

What form does it generally assume in the intertropical climates, and places where it is endemical? — A most fatal and violent one.

What form does the mild remittent generally assume? — The double tertian or quotidian, but the exacerbations are more severe on alternate days.

Should a mild remittent continue longer than the ninth or twelfth day, and the remissions become obscure, and the patient being no better, what would you prognosticate? — That its mild character was about changing to that of a more dangerous one.

What are the marks of increased aggravation? — The tongue is more loaded and brown, and dry along the middle; delirium is more conspicuous; the skin is deeply tinged with yellow, and there is great heat during exacerbation; debility greater; bowels filled with gas, and tender; retention of urine; morbid vigilance, &c.

When remittents attack a patient suddenly and vehemently, what are we to prognosticate? — A highly dangerous form of the disease.

When the second paroxysm shows itself, what is its general nature? — More violent than the first, either tending to high inflammation or decided depression.

After these bad symptoms, may a patient still recover? — Yes.

What are some of the fatal signs? — Scarcely any remission, with bloody exudation from the gums and fauces, hemorrhage from nose and bowels, great jactitation, subsultus, picking of bed clothes, and all the more malignant signs.

When does death generally supervene? — From the fourth to the eighth day.

What are the characteristics of the malignant variety? — It generally commences with feelings of feebleness and languor, general collapse of the vital powers, and great depression of the circulation, followed by reaction, with great pain over the eyebrows, feeling as if the skull was girt with a cord; the skin is dry and hot, and harsh, the countenance is flushed and purple, with appearance of collapse, and great pain; the tongue is clammy, and coated with yellowish fur, sometimes rough, dry, and brown.

How long does this state generally continue? — Twelve hours.

How long does the remission last? — Generally from five to six hours.

What are now the symptoms? — Great increase of bad signs, the temperature is unequal, some parts being warm, others being cold and clammy; the eyes are glassy and sunken; blisters will not draw; breathing hurried; teeth covered with sordes; nausea is present, &c.

What is the next step in the disease?—Another remission; and then exacerbation, with increase of all the previous bad symptoms; and also new symptoms still more malignant occurring, as great subsultus, vibices, petechiæ, bloody discharges from all the mucous surfaces, intermitting pulse, &c.

What are some of the complications of this disease?—Disorders of the liver, alimentary canal, and brain, &c.

How may this fever terminate?—By perfect recovery, or conversion into intermittent fever, or death by syncope, convulsion or exhaustion.

When does convalescence usually commence?—From the fifth to the eleventh day.

What are some of the critical discharges, &c.?—Perspiration, bilious discharges, and by vesicular and pustular eruptions.

When does the disease gradually abate?—From the seventh, fourteenth, and twenty-first days.

When remittent fever changes to intermittent, after which paroxysm does it usually happen?—The third or seventh.

Pathological Characters.

What are the general pathological characters of remittent fever?—They are various; but the stomach, liver and brain seem to be the most affected, the more particular marks of it are gastro-enterité, with slight dothinenterité; a flabby state of the liver, and of a bronze colour, the spleen enlarged and softened, &c.

What are the causes of this fever?—The same in general as those of intermittent.

Who are those most liable to it?—The same class as those of intermittents.

Treatment.

What are the indications to be fulfilled in the treatment of this fever?—To moderate febrile action, to remove acrid and irritating matters from the primæ viæ, and to obviate gastro-intestinal irritation, and restore healthy function.

How would you answer the first of these indications?—By bloodletting, and by gentle emetics and diaphoretics.

Would you, in every case of remittent fever, resort to the lancet?—No; not in the very mild varieties, or in those of decided prostration.

How would you answer the second indication?—By gentle but efficient cathartics, viz., hyd. chl. mit., and col. comp. ext. in combination, and their action kept up by ol. ricini, magnesia, &c.

How would you fulfil the third indication?—By topical depletion, sinapisms, vesicatories, demulcents, &c.

How would you restore healthy function?—By alterative doses

of mercury, mild enemas, and cathartics, cold drinks, mild diaphoretics, &c.

If it is necessary, how would you bring the system speedily under the action of mercury?—By large and frequent doses, combined with an opiate, and the use of ungt. hyd.

Which are the best articles to be used in great gastric irritability? — Mucilages, as gum acac., and iced acidulated drinks, and sometimes by letting the stomach rest; lime water and milk is very beneficial.

How would you induce diaphoresis? — By using the liq. am. acet., mist. neut., aided by tepid and cool sponging.

Should the disease seem to localize itself, what must be done? — Direct our attention and remedies to the organ particularly affected.

What must be done should the fever run to malignancy?—General and local stimulation must be used; and sometimes the bark and its preparations must be resorted to.

Should the diet of the patient be regulated? — Yes; great care must be paid to it; the mild and nutritive varieties are the best.

During convalescence what is necessary? — Administer mild tonics; the cold infusion of cinchona, made with lime water, by the displacement process, and infusions of gentian, colombo; regulate the bowels, and keep the diet simple, mild, and nutritious.

PERNICIOUS, OR CONGESTIVE FEVER.

Is this, properly speaking, a *peculiar fever*, or *a stage or complication* of some of the forms of intermittent and remittent fevers? — Rather a stage or complication, but of so critical a character that it deserves more minute attention.

How are the symptoms of this variety denoted? — In some cases we have the organic functions more particularly affected, as those of respiration, circulation, digestion, calorification, and secretion. In others, those of the animal, as the brain, spinal marrow, &c. In almost every case, these are all more or less affected.

How does an attack generally commence?—In some cases it comes on at once; in others it follows in the course of an ordinary intermittent or remittent; sometimes with chilliness and aggravation of all the ordinary signs of these fevers, with great prostration; and, again, sometimes without any warning.

What are the symptoms as evinced by the organic functions? — The general appearance of the patient is peculiar, as evinced by the livid paleness of the face, hands and feet; shrunken features, and anxious expression of the countenance; the eyes are sunken, though bright; the extremities, and sometimes the trunk, cold, though not apparent to the patient; skin sometimes clammy; and sometimes the trunk is hot while the extremities are cold. The tongue is varied in character—sometimes dry, pale and cold, and sometimes almost na-

tural; oppression at the epigastrium, with intense thirst, and when drinks are taken, they are immediately thrown off; often there is constant retching; the bowels are sometimes confined, though frequently the reverse, and frequently blood is passed at each evacuation; the respiration is laboured and sighing, but sometimes the reverse; the pulse is irregular, corded, and often feeble, and fluttering and frequent, often from 120 to 160 in a minute. There is also great jactitation and restlessness. The patient is often unconscious of his danger, and insists upon rising when almost in the last extremity. This condition may exist for some time, from one to three days, with a general aggravation of the symptoms, and death ensue; or the symptoms may become more mild, and reaction take place, with a general amelioration of the symptoms. This may be only a remission, and on the ensuing day, or day after, we may have a return of all of the previous symptoms, greatly aggravated, unless prompt measures have been used.

What are the symptoms as evinced by the animal functions?—We have greater or less stupor, from drowsiness to deep coma; difficulty in enunciation, or forgetfulness. The respiration is frequently stertorous; the pulse is full; sometimes the jaws are clinched, and, when forced open, deglutition is frequently difficult, or impossible; sometimes there is tetanic spasm. These symptoms may be more or less aggravated. If the comatose paroxysm does not terminate fatally, we have more or less reaction; but if another paroxysm should occur, it generally terminates fatally.

Is not the diagnosis of this form of fever highly important?—Yes; the more important signs of any of the forms of fever running into this, are an unusual paleness or lividness of the face; a feeling more of chilliness than decided rigors; a want of uniform heat after reaction; a disposition to frequent vomiting and purging; oppression at the epigastrium; a disposition to faintness, and restlessness; extraordinary frequency, feebleness, or irregularity of pulse; confusion of the intellect, drowsiness, &c.

What are the anatomical characteristics? — The arachnoid and pia mater are injected, and the substance of the brain is increased in density, and injected, effusion into the ventricles also is seen. The spinal marrow is similarly affected; the mucous membrane of the stomach is softened or thickened; so also that of the duodenum and jejunum. The liver is variously affected, either red and soft, or enlarged, yellowish, dry and brittle, or engorged with blood, or softened. The spleen is enlarged and congested.

Treatment.

What must be done if the patient is seen in the first paroxysm? — Bring about reaction as speedily as possible by artificial stimulents, heat externally applied, and hot frictions; rubefaciants to the spine and extremities, or by flying blisters. Internally, opiates are indicated

as a stimulant and to arrest alvine discharges, either alone or in combination with acetate of lead. The oil of turpentine and capsicum should be freely used; and ammonia, or the alcoholic stimulants. Sulphate of quinine should be given in the paroxysm, with calomel in combination, and opium, if the brain is not seriously implicated. These latter remedies should be given frequently and continuously, according to circumstances. In some cases, effusion with cold water has been extolled by some physicians. When reaction has taken place, we must treat it as in ordinary cases of bilious fever, watching carefully that there is no tendency to sink again. If there has been symptoms of coma, or affection of the brain, blood may be taken locally, cold applied to the head, and sinapisms to the extremities.

What is necessary when we have a remission, or intermission?—Administer large and continued doses of sulphate of quinine under all circumstances.

YELLOW FEVER.

Why has this disease been termed yellow fever?—From the peculiar tinge of the surface of the body during its continuance.

What are the characteristics of this fever in regard to violence?—It is very variable; sometimes being very severe, at others, again, assuming a mild form.

Where does this fever prevail?—At certain seasons of the year in the West Indies, Spanish America, East Indies, coast of the Mediterranean; and in the United States, at different ports where it has been brought.

What are the symptoms of yellow fever?—The attack is not always preceded by well-marked symptoms, though the disease generally commences with a sense of giddiness and pain in the back, loins, and extremities, and all the natural powers are depressed, and spirits broken.

How has this fever been divided?—Into three varieties: the fatal, severe, and mild.

What are the peculiarities of the fatal cases?—Intense headache, accompanied with chills, shivering, pain in the limbs and back; giddiness in the head; the heat is not very intense, succeeded by chills, and followed by gentle perspiration; the countenance is red, animated, and sometimes swollen; the eyes are red, glistening, suffused, and smarting; the appetite is gone, and the thirst is intense; pain over the epigastrium usually supervenes in fifteen or twenty hours from the onset of the disease, but it is inconsiderable; nausea or vomiting is present, and the evacuations from the bowels are not frequent; the abdomen is soft, and not painful, except at the epigastrium; there is much restlessness, and often great jactitation; delirium generally supervenes upon the last day of life; there is not much stupor or prostration previous to this, excepting in a few instances; the pulse is moderately accelerated, regular, and generally bearing

a relation to the heat of the surface; the skin of the chest is injected, but it gradually diminishes towards the middle of the disease.

What succeeds to the injection of the integument of the chest? — A slight yellow tint of the part, and also of the eyes.

What is the condition of the matter vomited, and the evacuations? —From being yellow it becomes black and brown; the evacuations are blackish in colour.

What is the general condition of the patient at this time? — Uneasy feelings and great anxiety exist, the strength is diminished, the temperature of the body falls, so that the limbs are sometimes absolutely cold, the urine is sometimes suppressed.

Are there ever, in fatal cases, symptoms of great mildness?—Yes; sometimes the patient dies, as it were, on foot, and without taking to his bed.

In the second variety, or the severe cases, how do the symptoms vary from the last variety? — Only in degree.

What is the condition of the stools and matter vomited, &c., in these cases? — Black, and the matter vomited is brown or black, especially in children; there is, also, not as much jactitation as before.

On what day do the symptoms abate? — On the fifth.

In the last, or mild variety, how does the case commence? — With all the preceding symptoms vastly modified.

Is the diagnosis of yellow fever difficult? — No; not if it is epidemic; and also when there is present great irritability of the stomach, black vomit, and yellowness of the skin.

Is there much difficulty of diagnosis in mild cases?—Yes; it sometimes resembles nothing more than mere continued fever.

What is the ordinary duration of this fever? — From five to seven days.

Should the patient pass the sixth day without the black vomit, what would be the prognosis? — Favourable.

Are relapses uncommon? — No.

Is the black vomit an equally unfavourable sign in adults and children? — No; in children it may happen, and they not unfrequently recover.

What are the causes of this fever? — A union of local emanations, favoured by an inquinated atmosphere; or, in other words, it is an endemico-epidemic.

What is the precise nature of these emanations? — We do not know.

Is this disease contagious? — Great difference of opinion prevails on this point, but the majority of writers think that *it is not.*

What are the pathological conditions of this disease? — The most striking are morbid alterations of the liver, it being pulpy, soft, yellow, and its structure sometimes being completely destroyed, and looking like rotten cork.

Is the spleen affected? — Yes; it has been found altered similarly to the liver.

What is the state of the stomach and bowels? — The stomach and bowels contain more or less of the dark matter vomited during life, and the mucous membrane has been found vascular and of a dark-red colour, and, in some cases, gangrenous.

What is the supposed source of the black vomit in this disease?— To blood effused from the abraded surface of the stomach, coagulated and floating in the gastric juice and fluids of the stomach, and also partially from animalculæ.

Upon what has the yellow hue of the skin been supposed to depend? — Upon the bilious matter being deposited under the cuticle, or upon an altered condition of the blood.

What are the indications for treatment in this disease? — To subdue inflammation and irritation of the system, and prevent local congestion and inflammation, and to sustain the system and prevent collapse; and, when inflammation is subdued, to sustain the powers of the system.

How would you answer the first indication? —By bleeding, local and general, purging, and by slight mercurialisation.

How would you favour the second indication? — By cordials and stimulants, following ptyalism.

How should bloodletting be used? — In states of high inflammatory excitement it should be used quickly and copiously in the onset.

What purgative would you chiefly rely on? — Calomel, both on account of its purgative and constitutional effect.

In cases of a strong febrile action, would you sponge the body, and use other cooling means? — Yes.

Should the stomach be much irritated, how would you overcome it? —By means of the usual demulcents, refrigerants, and counter-irritants, and purging if necessary by enemata.

Has there been any other kinds of treatment suggested? — Yes; the milder, or Broussais' treatment; and the decidedly tonic treatment.

What is the former variety? — The soothing and less active, from the very commencement of the disease.

What is the second? — By means of large doses of quinia in the incipient stage, from twenty to thirty grains.

Has there been any other treatment? — Yes; the saline treatment of Dr. Stevens.

HECTIC FEVER

What is a hectic fever? — A fever of indefinite duration, with from one to two exacerbations in a day, accompanied with attenuation of body, and depending either upon suppuration or important organic derangements of structure.

How is the pulse? — Frequent and varying (between 90 and 120), irritable, small, jarring, and yet compressible.

How do the exacerbations occur? — Irregularly, preceded by chills,

heat of skin, flushed features, and burning in the palms of the hands and soles of the feet; and not always followed with perspiration.

When does it most regularly occur?—In the morning, and fore part of the night.

How is the digestion?—Not unfrequently, though not invariably, disturbed.

Is there much debility?—Yes; in proportion to the fever.

As the disease advances, do these symptoms increase?—Yes.

In advanced hectic is the appetite affected?—No; but at the very close of the disease it is much affected.

Is the thirst urgent?—No.

Are the excretions natural?—Yes, generally

What is the condition of the integuments?—Pale, bloodless, and blanched, with crooked nails; and during the exacerbations there is a bright red, circumscribed spot upon the cheek.

Is there ever œdema of the lower extremities?—Yes.

What is the duration of this disease?—It is various, depending upon the fundamental cause.

Is the diagnosis of hectic of much importance?—Yes; as it modifies treatment.

With what is it likely to be confounded?—With certain forms of irritative fever, dependent upon chronic internal inflammations.

In such cases, however, what are the differences?—The exacerbations are more irregular, and they depend, or are connected with, the excitement of digestion.

Are there any other sources of error?—Yes; sweating early in the morning, depending generally upon debility.

What are some of the causes of hectic?—Internal suppuration, and also serious organic diseases.

What is the treatment of hectic?—Relieve, if possible, the cause, whatever it may be; where there is chronic inflammation simply, and that too curable by antiphlogistics, we resort to them; otherwise tonic systems of medication and alteratives are to be used, and the symptoms relieved as they occur.

What tonics and stimulants have been used?—Wine, mineral acids, bark, &c.

Should the atmosphere and diet for the patient be regulated?—Yes.

CONTINUED FEVER.

What is a continued fever?—One in which the remissions are not well marked. Or, "the changes constituting fever proceeding in one series, frequently with a tendency to exacerbation and slight remission."—[*Cop. Dict.*]

How is it divided?—Into simple continued, typhous and typhoid.

How is the commencement of continued fever?—Similar to remittent.

Do the symptoms vary in intensity? — Yes; we have sometimes high inflammation, at others great prostration.

Is there sometimes but little tendency for the disease to localize itself? — Yes.

How does uncomplicated continued fever usually terminate? — In speedy convalescence.

When death does take place, what do we find as the cause of it?— Inflammation and congestion of some internal organ.

Are the affections of the several organs particularly modified by this form of fever?—No; and consequently a minute investigation of them in this place is unnecessary.

What are some of the causes of continued fever? — Vicissitudes of temperature, impure air, crude food, &c.

What are the pathological characteristics of simple continued fever? — Few die of this form of disease, and when death does occur, we generally have the same marks as in remittent fever.

What is the treatment of continued fever? — In simple continued fever the treatment is the same as in remittent fever.

Does this fever ever run into the typhous state?—Yes; and we will now consider this type of the affection.

TYPHOUS.

What is typhous fever? — Fever, with a considerable and rather frequent pulse, little increase of the animal temperature, with extreme languor and debility, and without much disturbance of the mental functions. [*Lib. Pract. Med.*] Or, "by catarrhal and gastric symptoms early in the disease; by stupor, delirium, or typhomania; by a peculiar cutaneous eruption; by more or less evident affection of the liver; and by the determinate course and regular succession of all the febrile changes,"—[*Copland's Dictionary*].

Mention some of the symptoms of typhous fever. —It is sometimes sudden and sometimes gradual in its accession, attended at the commencement with slight chills; morbid heat of the skin, often intense and frequent; the pulse is increased in quickness, with softness and feebleness; the respiration is accelerated, often with the signs of bronchitis and pulmonary congestion; pain in the back, head, and limbs; dulness of the mental faculties; drowsiness or stupor; dizziness and deafness, with tinitus aurium; morbid sensibility of the skin and muscles on pressure; extreme prostration of the muscular power with *subsultus tendinum;* full and stupid expression of the countenance, with turgidity, suffusion of the eyes; loss of appetite with thirst; tongue slightly altered, or, in grave cases, it is dry red-brown and fissured; sordes on the teeth and gums; occasional nausea and vomiting, with frequently a sluggish state of the bowels; epigastric and abdominal pain, or tenderness; peculiar eruption on the skin, coming out between the fourth and seventh days of the disease, and declining at

uncertain periods; during the second and third week the odour from the patient's body is strong and offensively ammoniacal.

Do these symptoms not differ in intensity in various cases?—Yes; but sufficient are always present to mark the disease.

What is the peculiarity of the eruption in typhous?—It is general, extending over the whole body, and consists of a measle-like rash, slightly elevated, of a light red at first, but after the second day, or in severe cases, from the first of a darker tint, the papulæ are rounded and vary in size.

Who does typhous more frequently attack?—It spares no age, but is particularly severe amongst the aged and middle-aged, especially when they are exposed to the usual causes which induce it, as bad, confined air, diet, &c.

Are there any constant pathological changes shown by post-mortem examinations in this fever?—No; the brain and its membranes are frequently affected; and the mucous membrane of the bronchi, stomach, &c., while the blood is generally of a dark colour, often fluid and grumous; the coagula, when formed, soft, and non-fibrinous, &c.

Treatment.

What is the general treatment in mild typhous?—Very simple; a dose of oil, mustard pediluvia at night; neutral mixture or the ammonia acet.; if the face becomes flushed, a few cups to the nucha, and behind the ears; if constipation should occur a repetition of the oil, and at the close of the fever, if there is any tendency to collapse, we must resort to stimulants and nutritious diet.

What is necessary in the more severe cases?—Apply flying blisters over various parts of the body, leaving them on only for two or three hours; watch any tendency to cerebral symptoms, after proper general and local depletion; shave the head; apply cold to the head, or blister the scalp, or back of the neck; administer small doses of tartar emetic; do not allow your patient too free use of drinks; gentle mercurialisation, with stimulants and tonics, if the disease runs very low; sponge the body frequently, and watch particularly any of the complications which may arise, and treat them as in ordinary cases.

How is this disease propagated?—By contagion and infection.

How long does this disease generally last?—From twenty to twenty-one days.

Has there any other plan of treatment been suggested than that just mentioned?—Yes; the decidedly purgative.

What stimulants have been used with advantage?—Wine, opium, camphor, carbonate of ammonia, &c.

How would you regulate the diet?—Allow nutritious, unirritating articles.

What prophylactic measures are useful?—Ventilation, cleanliness, good, nutritious diet, proper clothing and fumigation, with chlorine.

TYPHOID FEVER.

What is typhoid fever? — A fever bearing a general resemblance to the last variety, but marked particularly by lesion of the glands of the ilium (Peyer's glands), meteorism, enlargement of the spleen, rose-coloured spots on the thorax, abdomen, and sudamina (it has been called also dothinenterité).

What are the diagnostic marks of this disease, according to *Louis?* —Epistaxis; rose-coloured lenticular spots on the skin; sudamina, when large and numerous; meteorism; a blackish and thickly-coated tongue; drowsiness, stupor, extreme debility, when not proportionate to the other symptoms; eschars upon the sacrum; ulceration of the surface when blisters have been applied; spasmodic movements, or permanent contractions of the muscles of different parts of the body (the latter is peculiar to this affection).

What are the marks of a certain diagnosis in the affection, according to *Andral?* — Youth, cephalalgia, diarrhœa, stupor, delirium, somnolency, petechiæ (rose spots), sudamina, epistaxis, intestinal hemorrhage, cough, tendency to sloughs or eschars, fuliginous character of the mouth and meteorism.

How may the symptoms of typhoid fever be classified for study? — Into those of the cerebral and nervous system; those of the skin; those of the abdominal viscera; and those of the thoracic organs.

What are those of the first variety? — Loss of strength, and prostration occurring early in the disease, singing in the ears, vertigo, and frequently epistaxis, pains in the head and limbs not so great as in remittent or intermittent fever, and there is more of chilliness than a chill.

Do the brain symptoms increase? — Yes; the patient becomes dull and stupid; and, if the disease is violent, he may become comatose.

Is there much delirium? — It is not invariable, though it generally shows itself at night, and in violent cases it is very great; and, when complicated with acute meningitis, we have violent raving.

Is there ever coma? — Yes; in fatal cases coma generally precedes death.

What are the peculiar appearances as regards the skin? — The exanthema is limited to the anterior portion of the trunk, especially the abdomen and thorax; it is papular, and the spots rather larger; eliptical; more elevated; few in number, often not exceeding six or eight, and rarely more than twenty; they appear later than those in typhus, but last about the same time; the sudamina are more frequent than those of typhous, and often appear in two crops, one set early in the disease, and the other during convalescence.

What are the abdominal symptoms of typhoid fever? — Diarrhœa is a frequent sign; flatulence with tympanitis; pain in the abdomen, sometimes in the epigastrium, and in the right iliac fossa; and there is also great anorexia.

What are the thoracic signs in this disease? — In mild cases they are moderate, but we may have the bronchial mucous membrane congested, especially the smaller tubes, which may produce bronchitis, or pneumonia of a severe character.

What is the condition of the pulse and capillary circulation in typhoid fever?—The pulse is not so frequent as in typhous, otherwise similar to it; the capillary circulation is languid, and the skin becomes of a dull or dusky tint, and the face is often of a deep red colour.

What is the state of the eye? — Bright and glassy.

Is typhoid fever ever infectious? — Rarely so, and rarely epidemic.

Is it ever sporadic? — Yes.

Does typhoid fever have a natural course? — Yes; and averages from twenty to twenty-one days.

What is the general plan of treatment in this disease? — Negative and defensive. In mild cases the physician should interfere as little as possible, prescribing laxatives, dry or cut cups to the nucha, rarely blisters.

What is beneficial towards the close of the disease? — Small doses of the mercurials, in combination with ipecacuanha.

Are tonics or mild stimulants ever necessary? — Yes.

In severe cases of typhoid fever, what is necessary? — You treat the case similar to typhous, watch it carefully, and observe any complications that may arise, and treat them as if they were alone, bearing in mind the peculiar debilitated condition of the patient.

Has an examination of the blood led to any definite results in this disease? — No; though it is thought to be less coagulable than in other morbid conditions.

What colour do the patches of Peyer assume? — At about a week from the commencement of the disease we find them of a dull white, changing, as the disease advances, to a deep red colour, with all the variety of shades.

Do the patches affected vary in number? — Yes; sometimes we have but one affected, at other times twenty or more; and the isolated follicles are also involved.

Where does this eruption commence? — At the termination of the ilium, and proceeds upwards.

When these glands ulcerate, do they ever involve more than the mucous coat? — Yes; they sometimes extend to the muscular and peritoneal.

Do these patches ever cicatrize? — Yes.

When does ulceration usually take place? — Sometimes before the twentieth day, and sometimes longer.

Do there ever exist peculiar alterations in the mucous coats of the pharynx and œsophagus? — Yes; but of a different character from those in the stomach and intestines.

Are the mesenteric glands ever affected? — Yes; they become enlarged, and sometimes softened.

Has the spleen and liver been found affected? — Yes; but the lesions differ materially in different cases.

What is the general estimate of the occurrence of the affection of the glands of Peyer? — In about ninety-eight in the hundred cases.

Mention cursorily, the chief distinctions between typhous and typhoid fever? — In investigating the symptoms of typhous and typhoid fevers, we observe the latter disease not confined to any particular season; it commonly attacks individuals of a particular age, and exposed to some unaccustomed mode of life, sometimes occurs at the same time with an epidemic of autumnal remittent, or of typhous; when the initial period of the disease has passed, typhoid fever may be easily recognised; 1st. Typhoid is usually a sporadic disease, on the contrary typhous is rarely so; 2d. Typhous is contagious, typhoid is not, under ordinary circumstances; 3d. The initial symptoms of the two chiefly differ in the greater stupor, dulness, and prostration of typhous, which are in contrast with the moderate cephalalgia and disturbance of the senses in dothinenterité. In the more severe cases of typhoid we may be led into error if we view the case only once, but not if we mark the changes from day to day.

When the disease is fully formed, on what do the distinctions between the two forms of fever rest? — The suffusion of the eyes, and dusky-red aspect of the countenance in typhous, and the extreme stupor of mind, even where positive delirium does not exist; 1. In typhous we have no constant abdominal symptom, and at first merely dulness on percussion, and feebleness of respiration at the posterior part of the lungs; 2. The difference of the eruptions in the two forms, and in addition to these we have in typhoid, prostration, somnolence, slow development of nervous symptoms not so marked as in typhous; and the abdominal symptoms, rash, &c., before noticed. [See *Louis*, *Andral*, *Bartlett*, and *Gerard*].

ERUPTIVE FEVERS.

What are eruptive fevers?—Diseases of the skin, accompanied by lesion of the circulation.

Are there any definite views in regard to the pathological relation existing between the eruption and the fever? — No; some consider the exantheme to be a true phlegmasia of the skin; others, a peculiar affection of the derm; some, but few, however, consider them to be modifications of gastro-enterite, &c.

In cases of eruptive fever what are the most favourable conditions? —The least amount of internal inflammation, and also of cutaneous irritation.

What is there peculiar in the principal eruptive fevers? — Capability of propagation; the appearance of the eruption on the very day it was predicted, the progress of the pustules to maturation, and their strictly limited nature.

How are the characters of eruptive fevers modified? — By the nature of the epidemic and by particular constitutions.

What are the principal points to be borne in mind in the treatment of eruptive fevers?—Whether the disease is complicated by internal organic changes, or modified by constitutional circumstances, also the season of the year and age of the patient.

Where are some of the greater dangers in eruptive fevers? — The sequelæ.

RUBEOLA, OR MEASLES.

What are the most common technical names for this affection? — Rubeola and morbilli.

Are there any distinctions between these two names? — No; not with us, but among the Germans they apply morbilli to measles proper; while rubeola is applied to entirely a different affection.

Has the diagnosis between measles, scarlatina, and variola, been very long settled? — No; to modern times we are indebted to the study of the distinctive marks.

How would you divide measles? — Into R. vulgaris; R. sine catarrho; and R. maligna.

What is thought to be the length of incubation of this disease? — From five to seven days.

Do the initiatory phenomena of this disease differ from those attending catarrhal fever? — No.

What are some of the first symptoms? — Chilliness and shivering, coryza and flow of tears; followed by nausea, anorexia, slight cough, with heaviness of the head and eyes.

When does the eruption make its appearance? — From the third to the fourth day.

What is its character? — We have small red spots, distinct from each other, circular, and slightly raised from the surface, and looking like flea-bites. Appearing first on the head, around the margin of the scalp, behind the ears, and gradually extending over the face, and then to the chest and limbs.

What form do the patches assume?—By the confluence of the red spots they assume a crescent shape.

What is the usual course of the eruption? — From its first appearance upon the face and thorax of the patient it gradually extends over the whole body, without much, if any, amelioration of the attending symptoms, and often usually proceeding from the fifth to the ninth day, when we have desquamation occurring in the form of a branny scurf, or scales.

Does the eruption ever appear upon the mouth and throat? —Yes; and in negroes it is the spot in which we are better able to detect the character of the disease.

Does diarrhœa ever supervene? —Yes; especially in children.

Are there any other discharges ever taking place? — Yes; epistaxis;

sometimes in the female uterine hemorrhage, occurring generally about the fourth or sixth days.

Do we ever have complications in the disease? — Yes; bronchitis, pneumonia, pleuritis, tracheitis, and laryngitis.

Are there not sometimes peculiarities in the mode of attack in this disease? — Yes; we sometimes have the eruption anticipating its usual time of appearanee; at other times we have the catarrhal symptoms existing for some time before the eruption; in some instances, the body is first covered with the rash, and sometimes, after the rash has subsided, it reappears.

What is the second variety? — Rubeola sine catarrho.

What is there peculiar in this variety? — The eruption proceeding without catarrhal or febrile symptoms.

What is the opinion of some in regard to the prophylactic powers of this form of disease? — That it is nugatory.

What is the third variety? — Rubeola maligna.

What is the character of this form of the disease? — The eruptive fever and the catarrh, from the first, are severe, and the fever assumes the typhoid aspect; and during the whole course of the disease we have local inflammations, especially of the lungs, and abdominal viscera.

Is there anything at the very onset of the disease to warn us of its malignant character? — Nothing; excepting that the fever is violent; with greater restlessness, thirst, and heat of skin.

How is the pulse and respiration? — The pulse is frequent, but soft and compressible, the respiration is hurried and oppressed.

How does the eruption make its appearance? — Irregularly; now appearing, and then disappearing.

What is the colour of it? — Various; at one point red, at another pale, livid, and interspersed with ecchymosis and petechiæ.

What is the appearance of the mouth? — The mucous membrane is dusky red or livid in appearance.

What is the condition of the abdomen? — There is tenderness over the epigastrium and abdomen generally, with dark and offensive stools.

Does the brain sympathize? — Yes; we have transient delirium with coma, and sometimes convulsions.

What generally supervenes? — Inflammation of the lungs and brain, which does not abate with the eruption.

What is the immediate cause of death in most cases? — Intense pulmonary congestion; in others, subsultus and convulsions; and, sometimes, the patient is worn out by diarrhœa and mucous discharges generally.

Is this form of the affection of frequent occurrence? — No.

Are the sequelæ of measles dangerous? — Yes; sometimes more so than the original disease.

What are some of the sequelæ? — In scrofulous children we have the lymphatic ganglions affected; and hence, troublesome inflamma-

tion of the glands of the neck, and tabes mesenterica, or chronic bronchitis, and tubercular disease of the lungs; troublesome diarrhœa; ophthalmia; and abscesses from the ear, and in the cellular tissue of the parotid; sometimes aphthæ on the tongue and mouth, degenerating to gangrenous ulceration, and also cutaneous affections.

What are the pathological characteristics of this affection?—Death rarely occurs during the eruptive stage of measles, and hence we are ignorant of the state of the mucous membrane of the trachea and bronchi at that time.

Where do we generally find the most injury?—In the lungs, or in the bowels from protracted diarrhœa (Laennec supposed the orthopnœa to arise from œdema of the lungs). We also have condensation of the tissue of the lungs.

What does this disease mostly resemble?—Roseola and scarlatina. It may be distinguished from the latter affection by the time intervening between the initiatory fever and the rash, by the character of the rash, and by the sequelæ.

When does the eruption of measles show itself?—On the fourth day of the fever; and in scarlatina on the second.

What is the difference between the rash in the two affections?—The rash of measles is crescent-shaped, while that of scarlatina is more diffused and irregular, and the rash of measles is of a raspberry hue, and that of scarlatina more of a vivid red.

What are the differences of the sequelæ?—Measles has more of pneumonic and abdominal symptoms, while scarlatina has generally inflammation of the serous membranes, as the sequelæ.

How is roseola distinguished from measles?—By the character of the rash, and by the absence of the accompanying symptoms, and also by the duration of the disease.

What is the prognosis of measles?—During the early stage it is favourable. The complications of the disease are the chief sources of danger, and the character of the epidemic, the type of the fever prevailing at that time; and whether the season be wet or dry (dry being the more favourable); and also whether the disease follows other infantile disorders, should be particularly marked.

What are the circumstances denoting danger?—Unusual violence of the eruption, especially when there are spasmodic twitchings or convulsions, the late appearance of the eruption, and it being of a dark livid colour; or if the thoracic or abdominal organs are implicated, severe headache, retrocession of the rash, petechiæ, &c.

Whom does this malady effect most seriously?—Adults.

What is the original cause of this disease?—We know not.

Is it contagious or infectious?—Both.

Whom does it more frequently attack?—Children.

Does it affect the system more than once?—Rarely.

When is it supposed to be most contagious?—During the primary fever.

What is the general treatment of measles?—Little should be done during the eruptive stage, except keeping the secretions in order, and the patient in a cool room, and upon a cool, demulcent diet and drinks.

Is sponging the body as beneficial in this disease as in other rashes? —No.

Are the usual expectorants of much benefit in this disease?—No

What should be the principal points to which the physician should direct his attention?—The thoracic organs, and abdominal viscera.

Is bleeding ever proper in this affection?—Yes; if there are pulmonary complications; but it must be used with great caution.

In very young children which is the better manner of taking blood, locally or generally?—Locally, by cups.

Should the eruption have subsided, would you take blood as freely as if the eruption existed?—No.

Does antimony or ipecacuanha ever favour the case when we have abstracted blood previously?—Yes.

How would you regulate the secretions after an attack?—By small doses of mercurials, and sometimes by epispastics, astringents, and farinaceous diet.

Should the rash recede after having made its appearance, what is necessary to be done?—If the retrocession follows cold, we use the warm bath, diaphoretics, and stimulating drinks, or if it should have disappeared through debility, give the more diffusible stimuli, combined with mild tonics, as cinchona, sulph. acid. arom., and wine.

Suppose the type to be malignant, what is necessary to be done?—Relieve the congested organs as soon as possible by venesection (if the age of the patient favours it), or by local depletion, together with good diet, diffusible stimuli; and the other complication must be treated as in other diseases, watch the patient closely.

SCARLATINA, OR SCARLET FEVER.

What is scarlet fever?—A febrile disease, of a contagious nature, having a scarlet efflorescence of the skin, and of the mucous membrane of the fauces, tongue, &c.

How has scarlatina been divided?—Into scarlatina simplex, scarlatina anginosa, and scarlatina maligna.

What are the premonitions of scarlatina?—It is ushered in with the usual signs of fever, cold chills, nausea, hot skin, frequent pulse, and thirst.

When does the eruption appear?—Generally in forty-eight hours, first appearing upon the face, neck, and breast, and gradually extending over the trunk.

What is the character of the eruption?—We have innumerable red spots, separated by interstices of natural colour, gradually coalescing, and the redness becoming diffused.

What is the feeling of the eruption?—Slightly rough to the touch, arising from the enlargement of the cutaneous papillæ.

Where is the eruption most apparent?—At the joints of the body.

If a heating regimen has been resorted to, what is the state of the cutaneous surface?—Great congestion of the cutaneous vessels, and sometimes miliary vesicles appear upon different parts of the trunk.

When does the rash usually decline?—Generally on the fifth day.

Does there ever appear during the course of the eruption small vesicles?—Yes; about the fourth or fifth day of the efflorescence.

Is this peculiar to this disease?—No; it is seen in other exanthemata.

How does the efflorescence of scarlatina simplex terminate?—By desquamation of the cuticle about the end of the fifth day, commencing where the eruption first appeared, and receding as it commenced.

What is the character of the desquamation?—Like scales or laminæ.

Are the exposed mucous surfaces affected?—Yes; they are very red and inflamed.

How are the papillæ of the tongue?—Elongated, and projecting through the deep coating of the tongue; and when the tongue is clean, showing themselves very prominently.

How does the affection of the mucous membrane terminate?—By resolution; and the whole disease generally terminates in a week.

What is the second variety?—Scarlatina anginosa.

How is this variety characterized?—By the precursory symptoms being more violent, and by the throat becoming stiff, with uneasiness in swallowing, increasing to the second day, and becoming soon more painful and difficult, with much swelling of the tonsils, uvula, and soft palate, and redness of the surface, extending to the posterior fauces.

Are there ever dark patches upon the fauces?—Yes; mingled with an effusion of coagulable lymph, which may be mistaken for ulceration of the mucous membrane.

Does this coagulable lymph extend to the larynx and trachea?—Not generally.

Does the fever always accompany the sore throat?—No; sometimes it precedes it, at others accompanies it, and at others, again, it is delayed till the appearance of the efflorescence.

What takes place upon the second or third day?—The throat becomes worse, the debility is greater, the pulse more frequent (as the febrile excitement increases), and unequal in strength, with oppression of the breathing.

What is the general condition of the skin?—The temperature of the skin is much increased, rising to 106° or 108°, and there is also harshness present.

What is the appearance of the tongue?—At its tip and edges we have a scarlet hue, and its papillæ much elongated.

What occurs towards evening?—Exacerbation of fever, much restlessness, and sometimes delirium.

Is there the same regularity in this as in scarlatina simplex?—No; the eruption is sometimes delayed in appearance, and appears irregularly; at other times it appears and then recedes, and its duration is longer than the S. simplex.

Does desquamation always follow?—No.

When does the anginose affection subside?—Generally with the eruption, though it may continue some time after.

Does this variety ever assume a more intense form?—Yes; and we sometimes have acrid discharges from the nostrils and ears, followed by deafness and inflammation, and suppuration of the parotid and cervical glands.

To what should we be particular to direct our attention?—To the state of the internal organs; and especially the serous membranes.

What is the next variety?—Scarlatina maligna.

How does this form attack a patient?—Similar to the anginose variety; but its true character of lowness of type soon developes itself, and the fever as typhoid.

What is the state of the skin, brain, pulse, &c.?—The heat of the skin is less intense, the sensorium much disturbed, and sometimes low, muttering delirium is present, the pulse is small, frequent, and irregular.

What is the appearance of the eye and countenance?—Dull; with a dark red flush upon the cheeks.

What is the condition of the mouth and fauces?—The tongue is dry and brown, or red, dry and glazed, and bleeds at the slightest touch, sordes on the teeth and lips, and the breath is very fœtid; the fauces is dusky-red in appearance, and dark incrustations form upon the velum palati, uvula, and, tonsils; and sometimes we have gangrene, with a viscid secretion impeding the respiration, and producing a rattling noise; and sometimes we have an acrid secretion from the nostrils.

What is peculiar about the rash?—Its irregular appearance, and its frequent retrocession during the eruption, and its colouring being paler than in the other varieties, except here and there, where the patches may be deeper in hue.

Is there ever a tendency to hemorrhage from mucous surfaces?—Yes.

What now becomes of the patient?—He sinks rapidly if his constitution has not been vigorous.

When patients resist the first violence of the disease, do they convalesce soon?—No; but struggle through many untoward symptoms.

How are some affected? — With diarrhœa, and sometimes with serous inflammation.

Does scarlatina ever change in its course, from being very mild to that of a very serious character? — Yes.

When and how does the malignant variety generally terminate? — In death, by the third or fourth day, or else with general anasarca.

Has there been any other variety marked by authors? — Yes, scarlatina without the exantheme.

How does this show itself? — Upon the mucous lining of the mouth and fauces, without any general efflorescence.

Is it ever bad in its character? — It follows the general laws of the exantheme.

What are some of the sequelæ of scarlatina? — Inflammation of the pleura, peritoneum, and sometimes of the arachnoid membrane and pericardium; and also, in some instances, we have bronchitis or gastro-enterite.

Are the joints ever affected? — Yes; we sometimes have purulent deposits in the joints.

Is dropsy ever a sequence? — Yes; in the form of œdema of the face, eyelids, and sometimes it is general, and involving the large cavities of the body.

Do we ever have dropsy in this disease from structural lesions of the kidneys? — Yes; we have what has been termed morbus Brightii.

When does dropsy usually occur? — From ten to twelve days from the appearance of the rash; sometimes earlier and sometimes later.

What would indicate the approach of dropsy? — Paleness of the countenance, increased languor, loss of appetite, furred tongue, costive bowels, scanty and turbid urine, and gastric irritability.

When is there greater danger from dropsy? — When there is effusion into the larger cavities.

When there is effusion into the ventricles of the brain, what generally takes place? — Diminution of it in other parts of the body, and soon convulsions, coma, and death.

Does the patient ever recover from dropsy? — Yes, frequently, where the kidneys are not disorganized.

In which variety are we more apt to have dropsy as a sequela? — In the anginose.

Are we acquainted with the precise pathological characteristics of scarlatina? — No; the blood, however, seems to be more particularly affected, and acts as the exciting cause.

What has been discovered by *post-mortem* examinations? — In some cases we have no morbid appearance whatever; in others, again, the skin seems to suffer from great congestion of the capillaries, and in S. anginosa, congestion of the mouth and pharynx, enlargement of

the tonsils, with depositions of coagulable lymph, sometimes of a dark colour, is observed; and in S. maligna the throat is livid in colour, sometimes abraded, and covered with a dark lymph, and in the thorax we find inflammation extending to the larynx, trachea, and lungs.

Are the abdominal viscera ever affected? — Yes; sometimes we have intestinal inflammation, and sometimes inflammation of the peritoneum.

From what cause is the appearance of the kidneys modified? — From the existence and duration of the dropsy.

What is the appearance of the arachnoid membrane in fatal cases? — When there has been much delirium, we find the arachnoid vascular and opaque, and sometimes serous effusion has taken place.

Is scarlatina contagious and infectious? — Yes, both.

Does the same individual ever have a second attack? — Yes; but rarely.

What is supposed to be the period of incubation in this disease? — From twenty-four hours to ten days.

When does scarlatina generally occur? — In the autumn; but very frequently we have it during every part of the year.

Which sex is the more liable to it? — The female.

What ages are most susceptible? — Youth; and the susceptibility decreases much after the thirtieth year.

With what are we more liable to confound this affection? — Roseola and rubeola.

How would you distinguish them? — See *Rubeola*.

What is the prognosis in this disease? — In S. simplex the prognosis is favourable, unless we have internal inflammation, or the type becomes changed; and in the anginose variety it is favourable, unless the local inflammation is severe, and the inflammation is extending, and there is much tumefaction present, or if delirium supervenes.

What is the prognosis from the appearance of the rash? — If the rash is dark-coloured and irregular in its appearance, the prognosis is unfavourable.

What is the prognosis of the S. maligna? — Unfavourable.

What are the favourable signs in the different types? — When it happens in young children, with no visceral inflammation, a plentiful and florid eruption, red colour of the fauces, and the exudations upon the throat disappearing, the pulse falling in frequency and increasing in power, the breathing becoming gentle, countenance natural, and a gentle perspiration intervening.

What is the prognosis when the disease attacks pregnant or puerperal women? — Unfavourable.

Does the prevailing character of the disease vary at different times? — Yes; sometimes it is decidedly mild, at others severe.

Treatment.

What general principles must be borne in mind when entering upon the treatment of this affection?—The prevailing type of the epidemic, and of the general continued fevers of the season.

Is there much interference necessary when the scarlatina is simple in form, and pursuing its course regularly?—No; the only thing required is to keep the apartments cool and ventilated, the diet mild and farinaceous, drinks cool, and the bowels gently open; and if the heat of surface is great, sponge the body with tepid or cool water.

Is the abstraction of blood by venesection ever necessary?—Very seldom; and when necessary to take blood we had better resort to topical depletion.

What should be our greatest care?—To watch the disease in its various stages, and guard against untoward symptoms.

What remedy has recently been introduced, and which has become popular in this fever?—That by inunction, or covering the whole body with oil, lard, or the fat of bacon, and constantly re-applying it as long as the fever continues.

What is the indication in the anginose variety of the disease?—To meet the local inflammation, and to treat it upon the general rules for the treatment of fever.

Should we make use of the lancet in treating the inflammations arising from this disease with as much freedom as in other affections?—No; we must be very guarded, as there is a decided poison in the system.

Have emetics been used with advantage in this affection?—Yes, in the beginning, when the tongue is much coated, nausea present, and tonsils swollen.

Are purgatives beneficial?—When used merely to keep the bowels in a fluid state they are, but active catharsis is prejudicial.

What should be the diet?—Farinaceous.

Is sponging as beneficial in this variety as the mild form?—Yes; and it often induces sleep.

Are gargles of much benefit?—Not much; but they may be used to detach viscid mucus.

Has chlorine ever been used with advantage?—Yes. The sol. sodæ chloridæ of the Pharmacopœia, ʒiss.; aqua, ℥viij.; syr. limon. ʒij. m. sig. Ten or twelve drops during the day. This mode is well adapted for its administration.

Should visceral inflammation supervene, what is necessary?—Vigorous but cautious measures should be adopted.

What diet is necessary when the fever subsides?—Tonic and nutritious.

What is necessary to be done when the throat is particularly affected?—Sometimes we use local depletion and poultices externally; pencilling with the argt. nit. internally, and sometimes blistering externally.

Is general bloodletting ever admissible in scarlatina maligna?—No.

Is it ever necessary to employ local depletion? — Yes, sometimes, but with great caution, leeching being the most proper.

Is a blister to the nucha in this form ever beneficial? — Yes; especially where the cerebral symptoms are very great.

Would you sponge as frequently in this form of disease as in the other forms of it? — No.

Must purgatives be administered as freely as in the other forms?— No.

Are emetics ever beneficial in this variety? — Yes; in the commencement, when there is still sufficient strength remaining.

What is necessary if the patient appears to sink? — Administer cordials, tonics, and mineral acids.

Which is the best tonic? — The preparations of bark with sulph. acid.

If the pulse is frequent and feeble, and there is delirium, would you still administer tonics and stimulants? — Yes.

Has the carbonate of ammonia been found useful in this disease?— Yes.

What gargles have been used? — Bitter infusions, the mineral acids, the infusion of capsicum, and the argt. nit., and creasote.

What treatment is found most beneficial in anasarca when a sequela? — The antiphlogistic, followed by tonics.

Are any of the cathartics beneficial in anasarca? — Yes; repeated doses of calomel followed by a slight drastic.

Is bloodletting ever necessary? — Yes, sometimes.

If there is a suspicion of dropsy from renal disease, what is proper? — To cup the lumbar region, and use counter-irritation and demulcents.

Which form of the diuretics is preferable? — The combinations of the alkalies with vegetable acids.

Is it ever necessary to use tonics and corroboratives in this dropsy? —Yes.

What is another form of disease that follows scarlatina? — A bloody and diffused cellular swelling, extending around the throat, with typhoid symptoms. *Vide* Graves and Gerhard, Lect. XIX., on Clinical Medicine.

Has there anything been suggested as a prophylactic in this disease. — Yes, the belladonna. [See *Library of Practical Medicine.*]

ERYSIPELAS.

See *Surgery*, p. 291.

VARIOLA, OR SMALL-POX.

What do you mean by variola? — An eruptive fever, propagated by contagion, running a definite course, and affecting an individual generally but once during life.

Do we know anything definite concerning its origin? — No; it is lost in antiquity.

Who wrote the most definite account of it? — Rhazes, an Arabian, in the tenth century.

What are the most convenient divisions? — The distinct, confluent, and modified.

Into how many stages is it divided? — Into four; the incubative, the eruptive, the maturative, and the period of desiccation and secondary fever.

What is meant by the incubative stage? —The period between the reception of the poison and the commencement of the visible signs of the disease.

What is the period of incubation? — From seven to fourteen days.

On what day does the eruption show itself? — On the eleventh or twelfth day; after the usual premonitory symptoms of other eruptive fever.

When the period of incubation is short, what is the prognosis? — That the disease will be more severe.

What are the symptoms of the distinct variety? — We have languor, weariness, pains in the back, and extremities, pain in the forehead, with flushes of heat, nausea, and epigastric tenderness, and when the fever developes itself we have the dry skin; the tongue white in the centre, and red at the point; the bowels torpid; the urine scanty, and of a deep red colour; the mind becomes dejected and confused; and on the third day the tongue is usually of a bright red colour.

Do hemorrhages ever occur? — Yes; sometimes during the first and second days of the fever.

What generally occurs in adults at about the period of the eruption? — A great tendency to perspiration, with drowsiness, and sometimes coma.

What generally precedes the eruption in children? — Convulsions.

What is the most characteristic phenomena of the eruptive fever? — Pain, and soreness on pressure of the epigastrium, with vomiting, and an increase in the febrile symptoms.

When does the eruption usually appear? —At the end of the third or the beginning of the fourth day from the commencement of the disease.

Where do the pustules first develope themselves?—On the forehead, and the parts about the mouth and nose; then on the upper extremities, and afterwards on the lower; and it is generally completed in twenty-four hours.

What are the characteristics of the eruption? — First, red points; then, on the second day, small elevations with inflamed bases, and the cuticle is distended by a semi-transparent plastic lymph; and at the close of the second and third day the pustules have a central depression, as if the skin were drawn tightly over a button-mould; the pustules gradually increase in size, and their umbilicated form in-

creases, and on the fourth day they assume a whitish colour, and become surrounded with a pale-red areola, which sometimes run into each other, and give a continuous red appearance.

When does the change from the serous to the purulent character of the eruption take place?—Between the fifth and seventh days, and marks the commencement of the stage of suppuration.

In the distinct variety, does the fever which accompanies the eruption increase or diminish as the eruption is completed?—It diminishes.

Does the fever reappear in the suppurative stage?—Yes.

As the suppuration proceeds, do the pustules change their shape?—Yes; they become spherical.

What generally happens about the eighth day?—The face becomes much swollen, and the eyelids are sometimes completely closed, and, as the disease progresses, the whole body becomes swollen.

What generally attends the period of suppuration?—Soreness of the fauces, and secretion of viscid saliva, with deafness; and at the close of the suppuration, a fœtid smell arises from the patient, and continues during the whole course of the eruption.

What circumstances modify the secondary fever?—The copiousness of the eruption and the activity of the suppuration.

In the distinct variety, how long does the secondary fever continue?—From two to three days.

When do the pustules arrive at the maturative stage?—About the twelfth day, and then gradually dry away.

Where does the desiccation commence?—Upon the face, and leaves a red surface, which gradually disappears; or, if the case has been severe, deep pits mark the spots where the eruption has been.

What are the symptoms of the confluent variety?—The pain in the back and extremities during the eruptive fever is more severe, and all the febrile phenomena are more intense.

What is the character of the eruptive fever?—It is generally inflammatory, though sometimes typhoid.

Do we have the same tendency to perspiration in this variety?—No; but sometimes instead of it diarrhœa is profuse.

When does the eruption appear?—Earlier in this form; and it is much more irregular in its several stages.

What is the peculiarity of the eruption?—The small, red, papular points, which appear at first, run into each other, and form a red, tumefied, and rugose surface, and the pustules are irregular in shape, and less elevated than in the distinct variety.

What is the condition of the face and hands?—They are much swollen.

Is there any soreness of the fauces?—Yes; and the flow of saliva is very profuse and acrid.

When the suppuration is complete, are the symptoms aggravated, or not?—They are aggravated, and the secondary fever developes itself.

What is the character of the matter in the pustules?—Dark in colour, and, in some cases, highly corrosive in character.

What occurs from the eighth to the ninth day of the eruption?—The matter escapes from the pustules and hardens on the surface in brown crusts, which fall off at periods from the fifth to the fifteenth day from their formation, and are succeeded by desquamations, which leave deep marks or pits.

Does the eruption attack the surface of the body only?—No; it attacks also the mucous membrane of the mouth, larynx, and trachea, producing more or less ptyalism, difficult deglutition, &c.

When this disease commences as an highly inflammatory affection, what are we likely to have as an accompaniment?—Inflammation of the brain and lungs.

When the brain is affected, what are the symptoms?—Delirium, coma, convulsions, and apoplexy.

What are the signs of thoracic complication?—Pneumonia, pleurisy, or effusion into the lungs.

What is the condition of the eyes?—Inflamed, and sometimes they are covered with pustules.

When the accompanying fever is typhoid in character, what are the modifications?—We have the usual signs of a typhoid state, and the pustules appear slowly and irregularly, and sometimes recede entirely; and the suppurative stage proceeds slowly and imperfectly.

What is the character of the matter in the pustules?—It is thin and watery.

When the swelling of the face subsides suddenly, what have we to fear?—Death from apoplexy.

When the desiccation commences, how is the fever?—Much aggravated.

Does this disease ever assume a malignant form?—Yes; especially the confluent variety.

What are some of the symptoms of this change?—Calor mordax, clammy and offensive perspiration, watery diarrhœa; the pustules are livid in appearance, and surrounded with a dark margin, and filled with a bloody serum; colliquative hemorrhage; and desiccation leaves dark crusts, under which we have phagedenic ulceration.

When pregnant females are attacked, what occurs?—Abortion generally.

What is the most important irregularity in this disease?—The crystalline variety, when, instead of pus in the pustules, we have a colourless, transparent serum.

What is the character of this variety?—Dangerous.

What is the type of the secondary fever?—Typhoid.

What are some of the sequelæ?—Slow and wasting fever; dropsy; cutaneous disease; ophthalmia; deafness; phthisis pulmonalis; mania; epilepsy; staphyloma, and cataract.

What are some of the *post-mortem* appearances, and how are they

modified?—The most general are sanguineous congestion of the brain and lungs; pustules in the pharynx, larynx, trachea, and bronchi. But these appearances are modified by the stage of the disease when death occurs.

What is the appearance of the pustules on the skin? — The cuticle is natural in thickness, exposing a white and smooth surface, elevated at the edge, and depressed in the centre; and instead of the mucous coat, we have a small umbilicated disk of varied thickness; and beneath this disk the derm is of a red colour, and sometimes covered with purulent fluid.

Where does the true seat of the pustule appear to be? — In the reticulated structure which lies between the cutis vera and the cuticle.

What is the cause of small-pox?—A peculiar contagious substance, of the essence of which we are entirely ignorant.

Does sex, climate, or season, modify it at all? — No.

Are all individuals equally susceptible to the operation of the contagion? — No; some appear absolutely insusceptible to its attack.

What has a tendency to moderate the virulence of the attack of this disease? — Reduction of the general vigour and plethora of the system.

Does a single attack of this disease prevent future attacks? — Most generally, but not always.

What is the prognosis in this disease? — In the distinct form it is not dangerous, but in the confluent variety danger is to be apprehended.

During what period of the disease does death generally occur? — During the suppurative and desiccating stages.

When is the disease most fatal? — When the pustulation is extensive, and when the complications are severe.

What state of fever is most favourable? — The moderately active state, but a tendency to a low grade is the reverse.

Does age modify the prognosis? — Yes; it is decidedly unfavourable in the old.

What are some of the other circumstances of an unfavorable character?—Pregnancy, puberty in females, convulsions during suppuration, suppression of the urine, or great desire to pass it during the suppurative stage; and the sudden recession of the eruption after its appearance.

What is the most approved treatment in this disease? — In the mild variety it is best to forbear the use of remedies regulating the diet and temperature; but when our aid is necessary, we adopt a course similar to that in other ordinary fevers.

What are generally the best remedies in the onset? — A mild emetic, followed by gentle saline laxatives, and mild diaphoretics, as ammon. acet., spirit. nitr. dulc.

Should the fever be high, with great local determination, what is

necessary?—Venesection, and topical bleeding over the different parts suffering.

When the surface is very warm, what is necessary?—Sponging with cold water.

When in children we have convulsions, what is needed?—The usual remedies in convulsions.

What should be the condition of the apartments of the patient?—Cool and well ventilated.

In the typhoid form of the disease what is the treatment?—That of other typhoid affections; relieving local congestions and sustaining the vis vitæ by means of quinia and opium, and gentle tonics, and stimulating applications generally, and if the patient sinks, we must resort to the freest use of cordials and diffusible stimuli.

What are some of the best applications to the surface of the body?—Mucilages, and Kentish ointment.

How would you prevent scaring?—By covering the face with mild ointment, or camphor; puncturing the pustules, and touching them with argent. nit. on the first or second day of the eruption; opening the pustules also when filled, and washing with milk and water. The chloride of soda as a wash is also highly beneficial.

Is it proper to exclude the light?—Yes.

How would you prevent the eyes from being injured?—By a bag of camphor being kept before them, and the usual remedies.

What gargles are the most efficient in sore throat?—Camphorated and detergent gargles.

Have there been any means adopted to prevent the ravages of small-pox?—Yes; inoculation and vaccination.

By whom was inoculation introduced into England?—By Lady Mary Wortley Montague.

By whom in this country?—By Dr. Boylston, of Boston.

In what way was inoculation performed?—By taking pus or lymph from a small-pox patient, and inserting it beneath the cutis near the insertion of the deltoid.

What effect has this upon the system?—It produces a mild form of the disease, and generally protects the system.

What is the treatment of the patient during the period of inoculation?—That for the mildest form of small-pox.

Is this much in use at the present day?—No; it has been superseded by vaccination; and in Pennsylvania there is a penalty for inoculating.

VACCINATION.

By whom was vaccination introduced?—By Dr. Jenner, on the 14th of May, 1796.

Does vaccination invariably protect an individual?—Not always.

What are the phenomena of vaccination?—On the third day from the insertion of the virus the wound is red and elevated; on the fifth

day, the cuticle is elevated into a pearl-coloured vesicle, containing a thin and perfectly transparent fluid, and the vesicle is circular or oval, varying with the mode of making the vaccination.

When is the vesicle in its greatest perfection? — From the eighth to the ninth day.

When does the vesicle change to the pustule? — From the ninth to the tenth day, when it is surrounded by a regular areola.

What is the character of the pustule when at its height? — It is round or oval, and elevated, with a definite margin, flattened surface, and central depression, resembling a button-mould bound tightly by the skin, to which it has been aptly compared by Dr. Chapman.

What is the condition of the scar left? — Small, striated, and cellulated.

Is there any danger from vaccination? — No, if done with healthy virus.

Do we not sometimes allay local inflammation when too high? — Yes; any of the mild cooling lotions may be used.

What are the characteristics of a good scab? — They are hard and compact, of a dark mahogany colour, and with a regular defined margin.

In vaccinating, what is necessary to be done? — To take some of the more compact portions of the scab, soften it, and then insinuate it gently under the cutis, endeavouring to avoid bleeding in the operation.

Is it necessary to make more than one point in vaccination? — No.

When vaccination is practised where the system has already been infected by small-pox, is the vaccine pustule modified? — Yes, in a marked degree.

Should rubeola or scarlatina supervene, would the vesicle be modified in its course? — Yes; it will be arrested, and it generally again resumes and finishes its course when the other affections have subsided.

Is it ever necessary to revaccinate a patient when the virus has taken? — No; but on this point there is still much difference of opinion.

VARIOLOID.

What do you mean by varioloid, or modified small-pox? — An exantheme, closely resembling small-pox, and generally acting upon a system previously protected by vaccination, or variola.

What are the symptoms of this disease? — Those of variola in a modified form, and irregular in duration.

Do varioloid pustules leave depressions in the skin? — Rarely.

What are some of the characteristic features of varioloid? — The eruption appears in successive clusters from the second to the fifth day; there is seldom complete suppuration; the eruption is not

attended by fever except in severe cases, and the desiccation occurs earlier than in regular small-pox.

What is the treatment?—Similar to that of small-pox in its simple form.

VARICELLA.

What do you understand by varicella?—A disease vesicular in its character, and arising from a specific infection.

Is an attack of varicella marked by any peculiarities?—No; it commences as other fevers do; and on the second or third day the eruption is disclosed, vesicular in character, appearing first on the face and upper extremities, and gradually covering the body.

Does the eruption appear all at once?—No; it is in successive crops; and while some vesicles are matured, others are just appearing.

What is the appearance of the vesicle?—It is about the size of a split pea, transparent, and covered merely with the cuticle.

Is there generally any secondary fever in this disease?—No.

When does the eruption dry up and desquamate?—In four, six, or eight days; seldom leaving pits.

Does varicella always maintain this mild character?—No; sometimes it is quite severe.

Are individuals who have had this disease once, liable to a second attack?—Not generally.

In whom do we find this disease?—Principally in children.

What is the treatment of this disease?—Generally very little is necessary to be done; and if anything is necessary, the treatment for simple variola is equally applicable here.

ARTHRITIC FEVERS.

RHEUMATISM.

What fevers have usually been placed under this head?—Rheumatism and gout.

What are the forms in which this affection presents itself?—The acute and chronic.

Who are most liable to the acute form?—Persons from fifteen to thirty years of age.

What are the symptoms of an attack?—Great pain, with much swelling of the parts, and their colour becoming of a bright rose-blush, afterwards the limbs and body generally become very painful on motion, and the fever also increases.

Does the diaphoresis which takes place alleviate the symptoms?—No.

When is the pain and fever greatest?—By night, and when the patient is warm.

Is there anything peculiar about the odour of the perspiration?—Yes; it is sour and pungent.

What is the condition of the patient generally?—He has no appetite; great thirst; and his urine deposits, on cooling, a brick-coloured sediment, the pulse is hard and full, seldom less than 90, and sometimes 120.

What parts of the patient suffer from this disease?—The fibrous tissues, joints, tendons, and sheathes of muscles; and effusion often takes place in synovial membranes and the cellular tissue contiguous to them.

When do the symptoms generally abate?—At the end of the first fortnight, by the decrease of fever, pain, and perspiration, especially at night.

Are we often troubled by exacerbations of the disease?—Yes; and complete convalescence is rarely established till the middle or end of the fourth or sixth week.

In those cases where effusion takes place, what influence is had upon the pain?—The pain is moderated, unless there is great distension.

When convalescence and recovery is complete, what becomes of the fluid effused?—It is rapidly absorbed; and the joints retain their natural form and motion.

What occurs when the fluid is not absorbed?—The ligaments continue in a thickened state, and the motions of the joints are decidedly injured.

What are some of the symptoms of a peculiarly interesting and important character, which generally attend upon an attack of acute rheumatism?—Those denoting some important *lesion of the heart.*

What are some of these symptoms?—Pain in the præcordial region, with palpitation, difficult breathing, and great oppression.

How do we ascertain the peculiar character of the affection?—By auscultation and percussion.

Which parts of the heart are affected?—Either the pericardium or endocardium, or both.

Where does the præcordial pain generally extend?—To the left hypochondrium, and is increased by pressure in the intercostal spaces, by inspiration, and lying upon the left side.

How is the pulse affected?—It is frequent, but most generally regular.

Do these symptoms continue for any length of time with equal intensity?—No; they are modified, generally, in the course of the twenty-four hours, and the patient is comparatively quiet, though effusion has taken place into the pericardium, and there is decided disease existing.

Do cardiac affections sometimes exist without the patient being aware of it?—Yes; and the physician is only aware of it by close physical examination, or judging from the peculiar look of the patient, and external phenomena.

What are some of the morbid sounds heard when the endocardium

is affected? — Modifications of the saw, or bellows' sounds, attending the systole, or diastole, or both.

At what point is the sound generally the loudest? — At that point of the præcordia where the heart's impulse is felt.

Which one of the sounds is generally altered? — The systolic; and at the point of impulse the diastolic sound seems lost in a prolongation of the systolic.

Where, then, would you say the chief lesion lay? — In the left cavities of the heart; and probably produced by a morbid condition of the aortic valves.

To what must be ascribed the want of discriminating the morbid diastolic sound? — Partly to the fact of the mitral valve being more remotely situated.

May we not have the lining membrane of the heart affected without altering the sounds? — Yes.

Should we then wait for the morbid sounds before we apply our remedies to the heart? — No.

If the pericardium has become the seat of inflammation, do the local signs change? — Yes; and we have signs denoting effusion of lymph and serum upon the membrane.

What are some of these signs? — Dulness on percussion, prominence, so that the interstices of the ribs are effaced in the præcordia, and a rubbing sound attending the heart's action; also the distance of sound in the heart's action.

Do the physical signs vary in duration? — Yes.

Which symptoms disappear first, the general or physical signs? — The general.

Do we generally have endocarditis with pericarditis? — Yes.

What affection often complicates rheumatic pericarditis? — Pleurisy.

When generally does the cardiac disease show itself? — From the eighth to the twenty-seventh day, or when the disorder is at its height.

When the heart is affected, does the affection of the joints diminish? — No.

What are some of the remote sequelæ of these rheumatic affections? — In pericarditis we have adhesion of the pericardium, scarcely modifying the heart's action; but in endocarditis we have narrowing of the orifices where the valves are situated, and hence impeding the action of the valves; or a roughened membrane and vegetations are produced.

Is hypertrophy produced by the obstructions thus offered? — Yes.

How does the case generally terminate? — In dropsy.

What is the disease which mostly resembles rheumatism? — Gout, which see, p. 434.

Is the pathology of the disease settled? — No.

What are the lesions generally met with? — All the effects of inflammation in the region of the heart (see *Pericarditis*); also peculiar inflammation of the joints and fibrous tissues.

What are some of the causes of rheumatism? — It may be hereditary, or produced by checked perspiration, and cold; and it sometimes appears without any assignable cause.

Treatment.

What are the principal objects to be kept in view in the treatment of this disease? — 1, To limit the dissemination of the disease; 2, to moderate inflammation when it occurs; 3, to moderate the affection of the joints, and prevent its becoming chronic; 4, to procure sleep.

How would you answer these indications? — By general bleeding, and purgatives of the saline character.

Should opiates ever be used? — Yes; they are of decided benefit.

What parts should be the subject of especial care? — The joints of the hand and feet, because they are subject to the chronic disorder.

What are some of the best applications? — Leeches, lukewarm poultices, or poppy-head poultices, or blisters.

What should be the diet?—Light articles, as the broths and wheys, with cooling drinks.

Should there be any danger from an affection of the heart, what is necessary? — Blood-letting, either general or local; and repeated local blood-letting, by cups and leeches.

Should these means be applied daily?—Yes; especially when there is anything of endocarditis present.

When should blisters be applied? — When depletion by venesection has been carried far, and the general excitement and heat of surface is diminished.

Would you keep the blistered surface open? — No; but allow it immediately to heal, and renew the blister on the return of pain, and this applies to any part of the body.

Is mercury of as great advantage as it has been reported? — No.

Are cups to the spine ever beneficial in this disease? — Yes; especially when there appears a neuralgic complication.

What are some of the remedies which have held a reputation in this disease? — Colchicum, calomel, and opium, Dover's powder, tart. ant. et. potass., cimicifuga racemosa, cinchona, green hellebore, aconite, delphinia, veratria, hyos., potass. iodid., lemon juice, &c.

Have the warm springs of our country any beneficial tendency? — Yes.

CHRONIC RHEUMATISM.

When does chronic rheumatism usually appear? — As a sequel to the acute, but often without any previous acute attack; and also entirely independent of it.

Has it any of the characteristics of the acute disease? — Yes; the principal difference lies, however, in the less activity of the attack and inflammatory fever, and the indefinite duration of the symptoms.

What effect has it upon the joints? — The same as in the acute

variety; ligaments become thickened, and the form of joints become changed, and their motions injured.

When is the pain more acute? — By night, and worse in moist than in dry weather.

In a less active form of chronic rheumatism, what are the symptoms? — Those of the acute variety modified.

Does this form generally impair the health of the patient? — Not immediately.

Does the heart become affected in primitively chronic rheumatism? — Not generally.

Treatment.

Is this form of the disease easily cured? — No.

From what are we most likely to derive benefit? — From local treatment.

What are some of the principal of these local means? — Local bleeding, then blistering, and dressing the blister with morphia.

What are some of the general remedies? — Diaphoretics, as Dover's powder, guaiac., sarsap., camphor; and, if fever exists, first use the saline cathartics, warm baths, &c.

What medicines have lately enjoyed a great reputation? — Potas. hydriod, and potas. nitras., and phos. of ammon., cod liver oil, lemon juice, and phosphate of ammonia.

Are frictions beneficial? — Yes.

What are some of the other means? — Thermal mineral waters, and residence in warm climates.

What is that variety of rheumatism called where the muscles of the loins are affected? — Lumbago.

Is this very painful? — Yes; the patient is sometimes unable to move or to change his position.

What is generally the cause of lumbago? — Lying on the damp earth, and violent efforts of the lumbar muscles.

What is pleurodynia? — An acute rheumatic pain resembling pleurisy, without the physical signs and general symptoms of pleurisy.

Where is this pain generally felt? — A little below the breast, and it is increased by pressure and the usual causes.

Do we have fever in pleurodynia? — Very seldom.

How is pleurodynia produced? — By cold, or other general exciting causes.

What is necessary to be done in these different varieties? — In lumbago we may cup the loins; narcotic linaments are also beneficial; keep the patient in bed, blister, and use the preparations of opium, and these remedies are equally applicable in pleurodynia.

May rheumatism attack the substance of the heart? — Yes, and sometimes causes hypertrophy.

GOUT.

What do you understand by this affection? — A constitutional disease, depending upon a peculiar diathesis, and manifesting itself by local inflammation and fever.

What class of society does it affect? — The rich and well fed; and attacks the male rather than the female portion of the community.

In which seasons of the year is it most prevalent? — Spring and autumn.

What are the general symptoms of acute gout? — Disorder of the digestive functions, with flying pains, drowsiness, restlessness, fever, &c.

Where does the patient first experience the greatest inconvenience? — In the ball of the great toe; and followed by great swelling, tenderness, and high colour; and afterwards it becomes œdematous.

What now generally happens?—Sudden release from pain by gentle perspiration, and the patient falling into a gentle sleep; and these symptoms may again return the next day, and so continue diminishing and increasing for from five to ten days.

Does anything occur to the cuticle of the affected part? — It generally peels off.

How is the condition of the patient during this time? — There is a loss of appetite with increased thirst; and the urine deposits, on cooling, an abundant brick-coloured sediment.

May not local injury produce gout?—Yes, in those predisposed to it.

Do these attacks frequently return? — Yes; as long as we have causes existing which foster a gouty diathesis.

Do these attacks ever observe periodicity? — Yes.

Do we often have gouty twinges before the attack? — Yes.

May not several joints suffer in succession? — Yes.

Do we ever have effusion into the cavities of the joints? — Yes; and then fever may be induced by it.

How is convalescence from gout indicated? — By diminution in the febrile exacerbations, restoration of healthy urine, and return of appetite

Are not the joints sometimes left very feeble? — Yes; but time produces a strengthening of them.

What is that condition in which the patient is left when, as the fever subsides, the local affection becomes less inflammatory? — Chronic gout.

What is the colour of the parts affected, and the other peculiarities in this state? — They are of a natural colour, or less red than in the acute variety. The pains in the joints are more wandering, alternating with pain and cramp in the stomach; and the patient is watchful and restless, and the limbs are disabled.

How is the general health of the patient? — Much impaired; the

countenance is haggard, and there is languor, debility, and depression of spirits, with the digestive functions injured.

Does chronic gout invariably follow acute? —No; but it may arise chronic from the commencement.

What do we find in these cases?—Chalky concretions in the joints, sometimes of a very considerable amount.

In what state is this effused?—In a semi-fluid state, as the hydrated lithate of soda.

What becomes of the more fluid part of this?—It is absorbed, and leaves behind a hard layer of the above.

Where do you find the most of these concretions? — In the joints of the hands and feet.

Do these concretions cause much pain? — Yes; from the pressure of these masses upon the joints.

What seems to be the principal deposition in the urine? — Lithate of soda, tinged with the purpurate of soda.

What are the external parts which seem most liable to attacks of gout?—Fibrous tissues; as the aponeurosis of muscles, and the sclerotica, cartilages of the nose, &c.

When does gout put on its most alarming aspect?—When it attacks internal organs.

When gout leaves the exterior of the body, and recedes to the internal organs, what name does it hold? — Retrocedent gout.

Where does this retrocession most generally take place? — To the stomach and bowels.

Do we ever have retrocession to the dura mater?—Yes; and symptoms of apoplexy or cerebral congestion appear.

What are some of the symptoms of gout in the stomach? — Vomiting, hiccup, great pain, and, when the bowels are effected, profuse diarrhœa; fever is present, and, if the patient is not soon relieved, collapse follows, and the patient dies.

What is necessary to be noticed in the two varieties of gout in the stomach? — The chronic variety is not inflammatory in its character, and the acute is; and the difference between the two may be learned from the history of the cases.

With what disease is gout most likely to be confounded? — Rheumatism.

From what are we to judge? — From the former history of the patient.

What are some of the symptoms differing from rheumatism? — Œdema of the affected parts, and desquamation of the cuticle; this is not seen in rheumatism. The variation from day to day is greater in this than in rheumatism. There is also very little, if any, perspiration in gout, &c.

What is the pathology of this disease?—It is inflammatory in character, sometimes hereditary, and chalky concretions are formed in the joints and tendons.

What is this chalky concretion supposed to be dependent upon?—Upon a super-abundance of lithates in the blood.

What are some of the effects of gout upon the parts attacked?—The joints are stiffened, the muscles dwindle, and the ligaments lose their elasticity.

What is the character of the stomach?—It presents a very peculiar appearance, not easily described.

What are some of the causes of gout?—High living, excessive use of malt liquor and animal food, and stimulants generally.

Treatment.

What is considered the most approved treatment?—The treatment of this affection has been very various, and with different degrees of success.

Is the old notion that an attack of gout acts as a safety-valve to the system correct?—No.

Is bleeding of advantage in gout?—Not unless the patient is very plethoric.

What is necessary to be done in a mild attack?—To keep the patient quiet, slight purgation, by means of magnesia, and restricting the diet to light farinaceous articles, and applying evaporating lotions to the part immediately affected.

What remedy has had a great reputation in this disease?—Colchicum.

Is leeching of the part affected of utility?—Yes.

When pain is very severe, are opiates justifiable?—Yes.

What were famous remedies in this affection?—The Eau médicinale d'Husson, and the Portland powder.

What are some of the other remedies that have been used?—Aconitia, delphinia, veratria, &c.

What should be given to overcome the lithic diathesis?—The alkalies and alkaline earths.

When we have chalky concretions, what remedy is of decided advantage?—Iodine, especially the potas. iod.

In retrocedent gout, what is necessary to be done?—Treat the symptoms as they arise, according to general rules, and endeavour to bring back, by revellents, &c., the gout to the original seat of attack.

In regard to the general regimen, what plan would you adopt?—Modify the diet; and if the patient has been accustomed to extraordinary stimulation, reduce the quantity of stimulus, inculcate exercise, &c.

What means would you adopt to prevent an attack?—Use gentle exercise, and pay attention to the digestive function. See *Dyspepsia.*

DISEASES OF THE RESPIRATORY ORGANS, ETC.

LARYNGITIS.

What are the simplest forms of laryngitis? — The erythematic and the catarrhal.

What are the causes of these? — Atmospheric changes, sitting in a draught of air, lying upon the ground, using acrid articles, and extraordinary exertion of the voice in singing, speaking, &c., and from continuity of inflammation in neighbouring parts.

How is the affection denoted? — By pain in the part, redness, and swelling, sometimes accompanied with fever, the voice becomes changed, and now and then the mucus expectorated is tinged with blood, and sometimes the disease may exist without any of the throat symptoms being cognisant to the patient.

What must be done in these cases? — Apply leeches to the throat, and counter-irritants, purging with calomel and rhubarb, use warm pediluvia and mucilaginous drinks and gargles, and sometimes dust the part affected with burnt alum, or touch it with argent. nit.

To what peculiar form of laryngeal inflammation has the term laryngitis been more exclusively applied?—To an inflammation of the submucous cellular membrane of the larynx causing œdematous effusion into it (*Williams*); this has also been called œdematous laryngitis.

How is laryngitis divided?—Into acute and chronic.

ACUTE LARYNGITIS.

What are the symptoms of the acute variety?—It often commences as an ordinary cold; and the throat soon becomes husky, followed by tenderness, pain, constriction of the larynx, and with a difficult and prolonged sonorous respiration; and fever being present, may first be inflammatory, but if the respiration is much impeded, it changes to that of an opposite character.

When the respiration is much impeded, what are the signs?—Anxiety of countenance, lips are livid, nostrils dilated, and the voice a whisper; and all the signs of suffocation are present.

What is the condition of the larynx when viewed?—It is generally red and swollen, and this appearance extends to the epiglottis and neighbouring parts.

In how short a time has death been known to take place? — In seven hours from the first attack.

Is there another variety of acute laryngitis? — Yes, the asthenic.

What are the peculiarities of this form?—Absence of inflammatory fever, and sometimes of pain in the larynx, and difficult deglutition; but the other symptoms of the two varieties are alike.

What sometimes takes place in this variety? —Œdema of the glottis; and the disease is often very rapid in its progress.

What are some of the causes of acute laryngitis? — Exposure to

cold and wet; or it may arise from tonsillitis, or by swallowing boiling or corroding liquids; and it often occurs in the course of the eruptive fevers.

What are some of the pathological characters? — Injection and thickening of the lining membrane, and œdema of the cellular tissue; inflammation of the epiglottis, with the production of serum and pus in the cellular tissue; and in the œdematous variety the folds of the glottis are so distended as nearly to close the orifice.

What are some of the diagnostic marks of this affection?—Hissing respiration, the seat of pain, the visible condition of the epiglottis, and absence of pectoral signs, distinguish it from disease of the chest. External abscesses may lead us sometimes into error, if not on our guard. It may also be distinguished from spasmodic affections by want of fever, and the suddenness of the attack in them, &c.

What is the prognosis in this disease? — Unfavourable, especially when the disease has lasted long, and the difficulty of breathing is increasing.

What are some of the most untoward signs? — Lividity of countenance, and obtuseness of the faculties from impeded circulation.

Treatment.

Does this disease require early and energetic treatment?—Yes; none more so.

What are the indications?—1. To prevent effusion by reducing inflammatory action; 2. When effusion has taken place, to prevent the obstruction which it causes to respiration from producing mortal injury to the functions; 3. To promote the removal of the effused matter.

How would you answer these? — By free bloodletting, but not to syncope; leeches and cups, locally, and repeated bloodletting, if necessary; calomel and tart. ant., as an alterative; counter-irritation to side of neck; inunction with the hydrarg. ungt., &c., blistering, and if spasm occurs, then dress the blisters with belladonna and morphia.

If notwithstanding all that has been done the symptoms increase, what is necessary? — The operation of bronchotomy.

How long a time should bronchotomy be postponed? — Sometimes for not more than thirty minutes, especially when the danger is imminent.

What is sometimes necessary? — To apply counter-irritation to the top of the chest, especially if there are any signs of bronchitis.

What is the most suitable treatment for the asthenic variety?—To put the system as quick as possible under the influence of mercury, and apply counter-irritation and depletion to prevent effusion, and, if necessary, support the strength by stimulants.

What is necessary to be done in some of these cases? — To resort immediately to bronchotomy.

What are some of the sequelæ of this disease? — Asthenic bronchitis, pneumonia, arachnitis, &c.

CHRONIC LARYNGITIS.

Which is the more common, this or the acute variety?—This

To what does this affection often succeed?—To a neglected catarrh, in those exposed to the vicissitudes of weather.

What are some of the symptoms of this affection?—Hoarseness and husky cough; soreness in the larynx, felt on local pressure or swallowing; change of voice; increased sensibility of the larynx, from slight causes; and sometimes purulent expectoration.

Does the respiration become affected? — Yes; and the difficulty of breathing appears more at night; and we have sometimes the dyspnœa increasing continually until death takes place.

What disease do we generally have in combination with this? — Tubercles in the lungs.

What are some of the causes? — It may arise from the acute variety, or from frequent catarrhal inflammation, especially in the intemperate; also from anything that may act as a continual stimulus to the organ.

What are some of the pathological characters? — Redness and roughness of the mucous lining; thickening of the submucous tissue; contraction of the ligaments, and general degeneration of the muscles; ulceration of the mucous and submucous tissues, and sometimes necrosis of the cartilages.

What are the principal diagnostic marks? — Permanent change of voice and peculiar cough, hissing breathing, and pain or tenderness of the larynx on pressure.

What is the prognosis of this affection? — In mild cases and good constitutions it is favourable; but in scrofulous habits, and where we have tubercules, it is unfavourable.

Treatment.

What are the indications for treatment? — To subdue chronic inflammation, and remove its bad effects, to relieve urgent symptoms as they arise, and to improve the general health.

What is the first thing requisite?—A perfect rest of the parts, and protection from irritating particles in the air.

Is local bleeding ever necessary, or counter-irritation beneficial? — Yes, by leeches applied at the sides of the larynx, and by croton oil, or ungt. tart. emet.

How would you modify diseased texture, and promote absorption in the effused part? — By a mercurial course, if there are no tubercles.

If mercury is hurtful, what other remedy would you use?—Iodine.

What are some of the local applications?—Argt. nit., cupri sulph., hyd. c. corros., applied by means of a brush, or strong solution, and iodide of zinc

What is necessary to relieve urgent symptoms? — When spasmodic cough is present, we use belladonna, camphor, ether, and opium, &c.

How would you answer the third indications?—By alterative tonics, good diet, and air.

LARYNGITIS MEMBRANACEA, TRACHEITIS, OR CROUP.

What are the symptoms of this affection? — The first signs are not distinctive, and seem essentially those of the catarrhal kind.

When the affection is at all developed, what do we have?—Stridulous respiration; a cough, of a rough, barking, ringing kind, followed by sonorous respiration, and the voice is very hoarse; there is also intense excitement of the circulation, hot skin, flushed face, anxious countenance, &c.

When do these symptoms generally occur? — At night; and then we have a slight remission, and an exacerbation, with increase of symptoms, on the next night, &c.; and, if the disease continues, the respiratory function becomes almost entirely stopped.

Does the voice become changed? — There is a cough present, and sometimes, in the act of coughing, the patient discharges a thick, tenacious substance from the trachea, and the voice becomes hoarse and whining, and sometimes suppressed.

How long a time may elapse before the disease reaches its height? —Sometimes in twenty-four hours, and sometimes not before several days.

What generally marks the stage of collapse? — Failure of the vital powers; difficulty of breathing being undiminished; pulse weak, thready, and irregular; cough more suppressed; voice gone; face swollen and livid; skin cold and clammy; and, if in an infant, we may have convulsions.

May patients recover, even in this stage? — Yes, by the throwing up of the albuminous exudation.

Are there any varieties of this? — Yes; the sthenic and asthenic.

Who do these varieties attack? — The sthenic attacks the robust and plethoric; the asthenic, the debilitated.

In whom does the spasmodic form of inflammatory croup occur?— In irritable children, and those of a nervous temperament.

Does there not sometimes occur a form of croup where there appears to be simply a spasmodic affection without inflammatory symptoms?— Yes; these cases are generally relieved by an emetic, and such medicines as allay irritability and spasm, as small doses of morphia in camphor-water, or tincture of hyoscyamus, &c.

What are the pathological characteristics in croup?—In early death we find injection of the mucous membrane of the larynx, trachea, and bronchi; and, at a more advanced stage, we have albuminous concretions upon the mucous membrane; and, in very inflammatory cases,

we have this membrane thick and tenacious; and sometimes the lungs are also implicated.

Has there yet been any satisfactory account of the essential nature of croup?—No; many and various opinions have been advanced, but the question is yet unsettled.

What are the diagnostic marks of this disease?—The peculiar sound of the breathing, cough, and altered voice; and when the disease is far advanced, we may diagnosticate it from disease of the lungs by the intercostal spaces being well filled up in breathing, and by a good sound on percussion; and it may be distinguished from spasm of the glottis, and hysterical affections, by fever being present, and the general history of the case.

What are the causes of this disease?—Exposure to cold and wet; eating indigestible articles; and sometimes it appears to be hereditary.

Who are more frequently attacked?—Children, from one to six years.

What is the prognosis in inflammatory croup?—Very unfavourable, especially if it is not attacked vigorously, and when it occurs in very young patients.

Treatment.

What are the indications for treatment?—To diminish febrile action, to prevent formation of false membrane and albuminous exudation in the air passages; and when these have formed, to promote their expulsion, and to subdue spasm; and lastly, to support the powers of life in the latter stages, so as to prevent spasm, and to enable the trachea to throw off the matters exuded.

How would you answer the first indication?—By an emetic of tart. ant. et ipecac., warm bath, and mercurial purgative, and by emetic of alum.

If the symptoms do not yield, what then is necessary?—Blood-letting generally; and leeching, and cupping.

What is necessary in the second stage?—Still to pursue the antiplogistic course, by administration of antimonials and mercurials, frequently repeated. Blisters have been recommended, but must be used with caution. Counter-irritation is highly beneficial.

How is the second indication answered?—By emetics and expectorants.

Which are the best?—While the pulse is full, tart. ant. is excellent; and when the inflammatory symptoms have subsided, squills and vin. ipecac. are good.

Are alkaline medicines beneficial?—Yes; these in combination with mercurials in large doses, are of decided benefit.

How would you assist in reducing spasm?—By means of antispasmodics, internally and externally.

In the last stage, when we have prostration, what is necessary?—Administration of stimulants and cordials, as brandy, ammonia, &c.

What should guide you in the treatment of the modification of croup?—General principles applicable to any of the complications where croup is not present.

Is tracheotomy of any advantage in croup?—Not generally, unless performed early.

Are relapses frequent in this disease?—Yes; and we should therefore watch our patient carefully.

Do we ever apply substances immediately to the larynx?—Yes, sometimes; and those, especially, that are applicable to chronic laryngitis, as argent. nit., burnt alum, &c.

LARYNGISMUS STRIDULUS, &C.

What is the history of this affection?—The attack comes on during sleep; the child starts suddenly; struggles for breath; face flushed, and swollen, and purple; and after repeated efforts, we have long inspiration, accompanied with a hooping or crowing noise.

What sometimes cause these attacks?—Irritation or tossing in the air by the nurse, or sudden exposure to cold air.

At what period does this generally attack children?—During the period of dentition, and it may occur frequently during the day.

What sometimes is the state of the hands and feet?—They are convulsively contracted, and the thumbs convulsively clenched on the palms of the hand, and the great toe drawn in; and sometimes general spasm is present.

Is this a nervous affection?—Yes.

What is the prognosis?—Various, as the disease may depend upon different causes; if it proceeds from intestinal or dental irritation, it will disappear as these are relieved; but if it depends upon cerebral influence, the danger is greater.

What may be done to relieve the spasm?—Dash cold water in the face; blow in the ear; use the antipasmodics; tobacco enema, &c.

How would you prevent it?—By removing the cause of irritation, and improving the general health and tone of the nervous system.

Is the dietetic management of importance?—Yes; great.

Is change of air beneficial?—Yes.

Are adults ever troubled with spasm of the glottis?—Yes.

What are some of the causes of this disease?—Pressure upon the larynx and trachea, or upon the nerves of the part from foreign bodies in the larynx or œsophagus; and from aneurism of the arteria innominata, &c.

What is the prognosis?—Unfavourable, as long as the original affection is of serious import.

What is necessary to be done?—To observe perfect quiet, and the use of antispasmodics, and nauseants.

Do we ever have anything like croupy affections in adult females? —Yes; especially the hysterical.

What is necessary for relief? — The remedies proper for hysteria; the use of the cold douche; spirits of ammonia to nostrils, &c.

What are some of the morbid productions sometimes occurring in the larynx and trachea? — Hypertrophy of cartilages; ossification of cartilages; tubercles; polypoid, and other tumours.

Do foreign bodies ever escape into the larynx and trachea? — Yes.

How would you dislodge them? — By an emetic, or the means pointed out by the surgeon.

BRONCHITIS.

Under what head are catarrhs usually treated? — Under that of bronchitis; they being generally the milder forms of bronchitis.

What plans of treatment have been adopted in catarrhs? — If the case is very mild, a warm pediluvium, an opiate at bed-time, and warm drinks, are all that are requisite; but if the case is more severe, we may resort to a mild cathartic, a nauseating or alkaline expectorant, and keeping the patient in an equable warm temperature, and letting him abstain from animal food, and all stimulants.

What plan of treatment was adopted by Dr. Williams? — Drying up a cold, or abstinence from all fluids for twenty-four hours, and favouring perspiration by warmth, &c.

In cases of coryza what is sometimes necessary, especially in children? — To steam the head over hot water or vinegar, or allowing a portion of tar to be evaporated in the room, and the use of the cubeb lozenge.

To what disease has the term bronchitis been applied? — To the various diseases of the respiratory organs.

Is this correct? — No; the term should be exclusively applied to inflammation of the bronchial mucous membrane.

How has bronchitis been divided? — Into the acute and chronic.

How are the symptoms of these varieties divided? — Into local and general.

What are the general signs?—Febrile excitement, enfeebled strength, chilliness, pains in the back, the pulse from 90 to 100 in a minute, with thirst, anorexia, headache, &c.

What are the local signs? — Cough, expectoration, soreness of the chest, and change in the respiratory murmur.

What kind of a rhonchus do you generally have at the commencement? — Sonorous; and this is heard more especially in the larger tubes, while in the smaller tubes we have sibilant, or whistling.

Is feebleness of respiration a more constant sign? — Yes.

What is the condition of the chest when percussed?—Clear at first; but becomes rather dull as the disease advances, and the tubes become filled as secretion occurs.

What sounds have we now?—The moist mucous, and subcrepitant, varying with the tubes affected.

What is the character of the expectoration?—At first it has nothing peculiar, but as the disease advances to resolution, or passes on to the chronic form, we have it then transparent, consisting of thin mucous; or thick, opaque, and of a whitish colour; and, if the disease is intense, we may have purulent matter mixed with it.

What is the duration of acute bronchitis?—A few days; and generally terminates favourably.

What is the pathological character of this affection?—We find the mucous membrane alone involved, with injection of the mucous membrane, ecchymosis, thickening, and induration.

Is there any difference in anemic patients?—Yes, the membrane is found pale and opaque.

Are ulcerations frequent?—No.

Is there ever an effusion of lymph and formation of false membrane?—Yes.

Do we ever have serous effusion in the submucous cellular tissue?—Yes, and the consequent œdema.

When this disease occurs as a primary affection, or, on the contrary, as a secondary, what is the prognosis?—When primary, and the disease of only partial extent, it is favourable; but when it depends on a secondary affection, as tubercles, it is unfavourable.

Must not our opinion of the dangers from bronchitis be modified by its prevailing as an epidemic, or not?—Yes; it is much more fatal when epidemic.

Treatment.

What is the treatment of this affection?—When the patient is of full habit, and much fever, the lancet is decidedly indicated, and antiphlogistics generally and counter-irritants; but in mild cases, we resort to nauseating and stimulant diaphoretics and expectorants.

Which are considered the best diaphoretics?—The vegetable.

What other articles are sometimes used?—Combinations of tart. ant. et ipecac.

Are cough mixtures beneficial?—Yes; in the first stages, those of an alkaline character, to which is added a mild nauseant. Afterwards when the disease is abated, we may use those of a more stimulating character, sometimes combined with an anodyne.

What are some of the modifying circumstances in the treatment of this disease?—Age, and the previous general health of the patient.

What two periods of life are peculiarly liable to this affection?—That of childhood and old age.

What is the peculiarity in children?—Its tendency to spread, and also pass to lobular pneumonia.

Which lung is more apt to be affected?—The right.

What are the physical signs in lobular pneumonia?—Very slight,

dry rhonchi; and we have subcrepitant rhonchus heard nearly always. The sound on percussion is clear, except when the tubes have been closed for some time, followed by loose cough, orthopnœa, flushing of the whole face, of a purplish hue, great febrile excitement, and cerebral symptoms.

What is the best treatment? — Local depletion, when necessary; nauseating expectorants, as ipecacuanha in syrup, and if much mucus is present in the tubes, sufficient to produce emesis; squills are also beneficial; sinapisms, &c.

Would you not frequently change the position of the child? — Yes; never allow it to remain more than two hours in the same posture.

In taking blood, what should guide you? — The paleness of the patient, and not the pulse; and in leeching, you should always be present to watch the effects of the quantity taken.

What are the peculiarities of bronchitis in old men?—Its variableness as regards the affected portion of the bronchial tubes, and its attacking the smaller tubes and similating pneumonia, and hence has been called *peripneumonia notha.*

From what does the patient suffer? — From dyspnœa, especially if the patient labours under emphysema.

Should your patient be robust, and you are called early, what is necessary to be done?—To resort immediately to venesection.

When secretion has taken place, and the patient is reduced, what is the danger in bleeding?—It prevents the expectoration, and causes greater dyspnœa.

What are the remedies, then, on which we rely?—Vegetable emetics, in small doses, and expectorants of a stimulating character, such as serpentaria or ammon. carb., or gum ammoniac.

When the secretion is lymph-like and tubular in form, what remedies are best adapted to the case? — Emetics and expectorants, and sometimes a resort to the mercurials.

To what diseases is acute bronchitis a usual accompaniment? — To measles, typhoid fevers, and most of the exanthematous affections.

What affections peculiarly favour the development of bronchitis? Disease of the heart and lungs.

CHRONIC BRONCHITIS.

From what does this form originate? — Sometimes it is chronic from its commencement; at others it follows the acute variety.

There are several varieties, what is the character of the common mucous catarrh? — A secretion of white mucus, sometimes puriform, and in irregular shreds.

What is the character of the febrile excitement? — Generally mild, and greater at night than day.

What are the physical signs? — Most rhonchus, now subcrepitant,

and now coarse mucous; and the respiration is sometimes loud and at others feeble; the latter generally preponderating.

By what, however, is our diagnosis made more sure? — By the absence of the signs which other affections of the chest present.

What disease often follows in the wake of this disease? — Tuberculous phthisis.

What is the treatment in this form of bronchitis? — That of acute bronchitis; and a free use of some of the balsamic preparations.

What should be our advice in regard to hygienic means? — If the disease is at all acute, confine your patient to the house; and if not acute, allow him to walk out in mild and pleasant weather; and sometimes a sea-voyage may be prescribed, and wearing of warm articles of clothing.

What are the characteristics of pituitary catarrh? — It does not follow the acute affection; and the local signs are those of the various rhonchi, both dry and moist, and a preponderance of the moist over the dry; and sometimes all the rhonchi are heard at once, and little fever is present.

What does it resemble? — The more acute varieties of catarrh; but is more intractable.

What is the treatment in this variety? — Nauseating expectorants. Lobelia is very beneficial. Bals. copaib., Venice turpentine, &c.

How would you prevent an attack of it? — By the use of cold affusion and quinine.

What other variety do you find? — Dry catarrh, in which there is little or no expectoration.

What is the prominent lesion in this variety? — Thickening of the mucous membrane.

Is there much febrile excitement? — No.

What is the nature of the cough? — Short and dry.

What is the state of the percussion? — Sonorous throughout, and sometimes more so than natural, from emphysema being present.

What is the state of the respiration? — Feeble; and sometimes a rough, rustling sound is heard; the dry rhonchus is sometimes also heard.

Where is the sibilant rhonchus usually confined? — To the anterior portion of the chest.

What other complication, besides emphysema, do we often meet with? — Hypertrophy and dilatation of the heart.

Is the duration of this disease longer than that of the other varieties? — Yes; and renders other acute affections which arise more difficult to manage.

On what does the treatment of this disease depend? — Principally upon hygienic means: as warm clothing, protection from vicissitudes of weather; and, if the patient insists upon medicines, the alkalies are decidedly beneficial.

What is chronic bronchitis frequently coexistent with? — Tuberculous phthisis.

Is not bronchitis sometimes dependent upon constitutional taint?—Yes; it may arise from syphilis or scrofula, and it then should be treated as these diseases generally are.

PERTUSSIS, OR HOOPING-COUGH.

What do you understand by hooping-cough? — A peculiar state of the nervous system, accompanied with bronchitis, and, sometimes, gastric irritation.

How often does this affection generally attack an individual? — Once in a life-time.

Who are the subjects most affected? — Children.

What is the character of the affection as regards duration? — It is self-limited, cannot be cured, but may be mitigated.

Do patients suffer from the bronchitis attending it? — Yes; in this lies the chief danger.

Is the secretion greater in this than in the ordinary varieties of bronchitis? — Yes; and it tends to the lower parts of the tubes, thereby causing dilatation.

When a fatal termination takes place, what is the cause? — Feebleness of the patient, and a consequent inability to expectorate; or, in children, to discharge the secretion by vomiting; or on account of the lungs becoming implicated.

Does the parenchyma of the lungs sometimes become affected? — Yes; and we then have pneumonia.

May we not have the brain implicated in cases of children?—Yes; acute hydrocephalus may occur.

What is the peculiar mark of the affection? — The hooping character of the inspiration, and its paroxysmal nature.

What is the character of the rhonchi? — Both dry and moist, and sometimes gurgling from the collection of mucus.

What is the character of the secretion? — Thick, glairy mucus; and it sometimes contains pus intermixed with blood.

What is the character of the countenance?—Bluish in colour, with puffed eyelids.

When fever occurs, what are we to fear? — Inflammation of the lungs.

May not the fever in it become typhoid? — Yes.

What should be our treatment in such cases? — That peculiar to that form of fever.

Is the diagnosis difficult? — No; not after the second week; we then have the paroxysms, whooping, &c.

What is the prognosis? — Favourable, when uncomplicated.

What should be our aim in the treatment? — To promote the secretion into the tubes, and favour its removal, and remove spasm.

What remedies favour this? — Mild emetics during the day, for a week or two, and mild nauseating expectorants, as ipecacuanha. Assafœtida is of great service, and alum, the alkalies, and friction along

the spine and over the breast, with the oleum succini, and other stimulant linaments.

Are revulsives to the chest serviceable?—Yes; especially sinapisms.

What remedies have been found very beneficial?—Belladonna, subcarbonate of iron, arsenite of potash, &c.

Is change of air beneficial?—Yes.

Is this disease contagious?—Yes.

PLEURISY, OR PLEURITIS.

What do you mean by pleurisy?—Inflammation of the serous membrane, lining the thoracic cavity, and investing the contained organs of respiration.

How many varieties are there?—Three; 1, simple pleurisy; 2, pleurisy with tubercular complication; and 3, pleurisy complicated with acute lesion of the parenchyma of the lungs.

What is the first pathological change which takes place in the membrane?—Injection of the vessels situated in the sub-serous cellular tissue.

What next takes place?—Development and effusion of lymph, which is generally deposited at the lower portions.

Is there much difference in the quantity of the lymph effused in persons of different temperaments?—Yes; in the plethoric and robust the lymph is deposited in larger quantities than in the lymphatic.

Should the inflammation exist for some time unchanged, is pus ever produced?—Yes.

What circumstances occur during the recovery of the patient?—As the serum is absorbed, the lungs and thorax approach near each other, and adhesion is the result.

What takes place in the adhesions?—They become organized, and new vessels are formed in the lymph.

Is the chest contracted by the adhesion taking place between the pleura costalis and pulmonalis?—Yes; and in the ratio to the quantity of the liquor exhaled.

What is the character of the fluid?—Mostly serum, or serum mixed with flocculi of lymph; or there may be purulent matter varying with the stage of the disorder.

How would you divide the signs and symptoms in pleurisy?—Into the local, embracing physical; and general.

What are the physical signs developed by these changes?—A rough sound in the respiration, like two pieces of leather rubbed together; dulness on percussion; and as fluid is effused we have dulness over the seat of the affection, increasing to flatness, and this flatness is much more marked at the lower than at the upper portion of the chest, owing to gravitation.

May not this flatness depend upon another cause?—Yes, upon the production of lymph; and the flatness then does not disappear when the position of the patient is changed.

What are we enabled to judge from the degree of flatness?—The extent of the effusion.

Does this flatness mark the declining stage accurately?—No; for the lung requires time to resume its usual elasticity

Is there ever much enlargement of the affected side?—Yes; and it varies with the quantity of the fluid effused.

Is the position of the heart ever altered?—Yes; it may be pressed by the fluid to the right of the sternum, or back to the left axilla.

What is the character of the respiration?—In the early stages feeble, depending either upon pain or effusion.

Do we ever have rude respiration?—Yes; when the lung becomes condensed, or the effused lymph is dense.

What is the character of the resonance of the voice, when we have bronchial respiration?—We have bronchophony, with a peculiar quivering in the tone.

What is meant by *egophony?*—When the bronchial respiration is rather feeble, and the effused fluid of moderate density, and not large in quantity, the resonance of the voice is less bronchial, and its vibration is increased, resembling the bleating of a goat.

Where is this generally heard?—From the anterior portion of the axilla to the scapula, and from thence to the spine.

Do we ever have little resonance, and no vibration of the voice?—Yes; and this depends upon the obstruction of the passage of air through the tubes.

What is another sign of pleurisy?—The friction sound; but it is very variable, and occurs at the commencement and at the end of the disease.

What is this dependent upon?—The almost entire effusion of lymph.

Are the negative signs of great importance in the diagnosis of this disease?—Yes.

Is the recovery from pleurisy rapid?—No; and the lung does not recover for some time its natural respiration.

What are the rational or general signs of this disease?—Pain; and, when severe, it is felt near the nipple, and it is acute and lancinating; and this pain may vary in degree, and is greater as the effusion is more extensive; and the cough, in the milder varieties, is generally short and insignificant.

How is the respiration performed?—In the beginning of the disease, when the pain is severe, it is performed mostly with the healthy lung.

How is the decubitus?—The patient rests upon the healthy side, and when there is much effusion he reclines upon the diseased side, to allow the healthy lung full play.

Does pleurisy have many symptoms in common with other inflammations of the serous tissues?—Yes.

What do we generally have at the commencemet of an attack?—Chill, followed by heat and sweating

What is the character of the fever?—Persistent, with a quick, tense, and small pulse.

Is there much secondary irritation?—No.

Upon what does the cerebral and intestinal irritation depend?—Upon the character of the fever.

Is the diagnosis of pleurisy difficult?—No.

With what is it most likely to be confounded?—With pleurodynia; but in this the pain is more shifting than in pleurisy, and there is generally no fever.

Is there much difficulty in distinguishing this from pericarditis?—Yes; especially where the left pleura is affected.

What is the prognosis in pleurisy?—Favourable in the simple variety; but if the effusion is large, or the disease chronic, it is doubtful; and when accompanied with tubercles, still more doubtful.

What is the treatment of pleurisy?—Antiphlogistic.

After a general bleeding, would you use local depletents?—Yes; taking the moment for their repetition when the pain is most acute.

What other applications are necessary?—Hop poultices and warm fomentations.

Are blisters of benefit?—Yes; when the active inflammatory symptoms have been checked.

Do they promote absorption?—Yes; and are hence beneficial in the more advanced stages—small blisters frequently repeated are decidedly so.

How would you guard your patient from relapse?—By application of a plaster to the side, and clothing the chest warmly.

What are some of the internal remedies?—Tart. ant., $\frac{1}{4}$th to $\frac{1}{8}$th gr., to produce diaphoresis in the commencement; followed by hydrarg., nitre, digitalis, squill, and colchicum.

What is the best remedy?—Hydrarg. chl. mit., in combination with Dover's powder, or ipecacuanha.

Are vegetable diaphoretics beneficial?—Yes; in the advanced stages.

How do anodynes act?—As palliatives, and are generally given in combination.

What is the best form to administer opium?—In Dover's powder.

If little fever still exists, and the patient has still effused fluid in his chest, what hygienic means would you resort to?—Change of air by a journey, and the application of iodine ointment to the side, &c.

CHRONIC PLEURISY.

What is the cause of chronic pleurisy?—This is difficult always to determine; it may follow a badly-cured acute pleurisy.

Is there often much effusion?—Yes; sometimes very great, but the patient may be unaware of it.

What are some of the signs of chronic pleurisy?—We may have

the rubbing sound as in the acute variety, or dulness on percussion, on account of effusion, and if this is great, the heart may be pushed to the right side, and the spaces between the ribs bulged out or flattened; together with these signs, there is often present, with slight cough, fever, often of a hectic character, with emaciation, flabbiness of the muscles, harsh and dry skin, and slight œdema of the limbs, &c.

Is the diagnosis of chronic pleurisy easy without the physical signs?—No; for it resembles phthisis.

How is the prognosis in this affection?—Unfavourable, especially if the effusion is large, and there is also a liability to the deposit of tuberculous matter in the lungs.

What is the treatment of chronic pleurisy?—Similar in many respects to that of the acute variety, although as a general rule, any of the depletents must be used cautiously, counter-irritation over the affected side, the use of iodine locally, together with its use internally, either in the form of Lugd's solution, or hydriodide of potash, or cod liver oil will be found beneficial. Pure, fresh air, and a nutritive, unstimulating diet, is highly useful.

How would you administer mercurials?—So as to favour absorption of the effused fluid.

Are tonics ever beneficial?—Yes.

Is salt-bathing of service?—Yes.

Is the operation of paracentesis of much service?—No.

LATENT PLEURISY.

What do you mean by latent pleurisy?—Pleurisy not indicated by the usual functional signs.

Upon what do you found your diagnosis?—Upon the physical signs and general disorder of the economy.

What are the physical signs?—Those usual in pleurisy.

What is the general course of the decline of the patient?—First, slight chill, followed by slight fever, slight anorexia and thirst, slight hacking cough, no expectoration, slight loss of strength, &c.

With what disease is it liable to be confounded?—Pulmonary phthisis.

What is the treatment?—That of the ordinary chronic form.

Is latent pleurisy ever a secondary affection?—Yes.

When it occurs during the course of a disease of the lungs, where is it most apt to develop itself?—Where the portion of lung which is nearest the serous membrane is affected, as in pneumonia, gangrene, and phthisis.

To what, however, do you chiefly direct your treatment?—To inflammation of the parenchyma, which is the cause of the pleurisy.

When we have much effusion, which is generally the more grave affection?—The pleurisy.

Is tuberculous pleurisy a disease of importance? — Yes; and it may either follow pleurisy, or *vice versâ.*

Does tubercular disease follow this affection or pneumonia more frequently?—This disease.

PNEUMONIA.

What do you mean by pneumonia? — Inflammation of the parenchyma of the lungs.

How does it commence? — Either as bronchitis, or it may arise in the substance of the lungs from the very commencement.

When the bronchi are first affected, and secretion takes place, does the disease soon yield?—Yes.

When the lobules are first affected, what takes place? — The exit for the secretion being closed, we have accumulations causing congestion.

What is the character of the fluid? — Bloody serum; and it may pass through the stages of lymph and pus.

How many stages is pneumonia divided into? — Four.

What are they? — 1st, engorgement; 2d, hepatization; 3d, yellow induration; 4th, softening down and removal by expectoration.

What are the physical signs?—In the first stage we have rude respiration with crepitant rhonchus, and the percussion flat or dull. In the second and third stages we have bronchial respiration in large tubes, and feeble elsewhere; mucous and subcrepitant rhonchus, and imperfect bronchophony, with percussion flat. In the fourth stage we have cavernous respiration with gurgling, with percussion flat.

May not several of these stages exist in the same lung? — Yes.

When the patient recovers, what course does the disease take?—It retraces the same steps that it has taken when approaching; and hence we call the signs, the signs of return.

Do all the signs of the affection immediately subside? — No; the bronchial respiration and flat percussion require time.

Is there no exception to this law of return? — Yes; in the third stage we have the mucous rhonchus first observed, and in the fourth stage we have the secretion of pus becoming less and less.

Does pneumonia always follow these rules? — Not always, except when it is of a perfectly frank character.

How would you divide the functional signs?—Into local, secondary, and general.

What are the local signs? — Generally, a bronchitic cough at first, but afterwards it becomes short and suppressed, or pneumonic, and sometimes the cough is absent. The frequency of the respiration is increased; but where only one lung is slightly diseased, it is only modified to a small degree. If one lobe is affected, we have respiration from forty to fifty in a minute; but if both, we have from fifty to sixty; and so, in proportion to the extent of the mischief, he breathes irregularly: it being high, and performed chiefly by one

side of the chest; and, after a time, we have abdominal breathing entirely.

What is the character of the pain?—The pain is variable, and proportioned to the inflammation of the pleura. When the inflammation is deep-seated the pain is slight; and in the old and feeble the pain is scarcely felt.

What is the character of the expectoration?—At the commencement it is mucous, then viscid and transparent, and, in some cases, it is rusty. Viscidity and transparency are, however, the characteristics.

If an abscess forms, what is the character of the sputa?—Purulent, and a large quantity is sometimes suddenly discharged.

What organs are secondarily affected, and what affections are apt to arise during the course of this disease in the lungs themselves?—Bronchitis and pleurisy almost always are attendants upon it; tubercles, emphysema, &c.; the heart is also often affected, the brain is affected, and if the cerebral symptoms are severe, we have the lung affection masked. The liver is, also, sometimes affected, causing what some authors call *bilious pneumonia.*

What other organs are affected?—The stomach and bowels, pharynx, œsophagus, and kidneys, &c.

What are some of the general symptoms?—We have suffusion of one or both cheeks, and of the whole countenance, varying from a bright red flush to a deep violet, modified by the dyspnœa, and after a slight chill a fever sets in, increasing with the close of the day; and the pulse is full, hard, and developed at the commencement of the disease, and in the latter stages it is often frequent, and from 100 to 120 per minute, and it is a good index in bloodletting.

Is the pulse not sometimes contracted?—Yes; and often upon the use of the lancet it rises.

What is the prognosis?—Variable; being favourable when a person has been in good health and treated early; but when the disease is complicated with affections of the brain, liver, or heart, it is more or less unfavourable.

What is the duration?—In mild cases, without treatment, it usually lasts from ten to twenty days; and if in the third stage, usually longer. By treatment from the very beginning we may shorten it.

When does death usually occur?—At the beginning of the third stage, or in the passage from the second to the third; and this stage usually occurs in three or four days, or at the beginning of the second week.

Treatment.

What is the treatment?—That of ordinary inflammations, modified by circumstances.

What is the first indication?—Bleeding freely at the onset in strong individuals, if the pneumonia is highly inflammatory; and this may be repeated according to circumstances.

When you are called late in the disorder, what is the most judicious practice? — To try the effect of small bleedings, or of local depletion.

In acute sthenic pneumonia is local depletion of as much benefit as general bloodletting? — No; local depletion appears then to be of more benefit in the latter stages of the disorder.

Are blisters of benefit in the acute stages? — No; but they are of benefit in the beginning of the third stage.

In what way are they beneficial? — By checking the inflammation and preventing collapse.

Where should they be placed? — Under the axilla, or between the scapula and spine.

Are sinapisms or other rubefacients serviceable? — Yes; as stimulants to the strength, and as a relief to the dyspnœa.

Is tart. ant. et potas. of much service? — Yes.

How has it been given? — Either as a diaphoretic, expectorant, or as an arterial sedative, the action of it varying with the quantity given.

What is the contra-stimulant plan? — Giving it in large doses, and continuing it for twenty-four hours, and then diminishing the dose till the third day, &c.

Is there any danger to be apprehended if the patient becomes comatose from the effect of the medicine?—Yes.

How would you obviate emesis or catharsis? — By combining it with opium.

What is the remedy next in power? — Mercury.

When given where there is hepatization, how does it act? — As an antiphlogistic and antiplastic.

How should it be given? — So as to produce a general impression upon the system, in doses from a quarter to half a grain, in combination with ipecac.

If the disease should not yield, what is necessary? — If we have a highly phlogistic state of system, either recur to depletents, or if the strength is failing, administer stimulants.

What are the expectorants of most value? — Eupatorium, and senega, or serpentaria.

Should the patient not seem to entirely recover, what is necessary? To guard the patient from cold by a proper dress or a plaster to the part affected.

Pathology.

What is the pathology?—At first we have engorgement of the lung by blood; secondly, we have red hepatization, the lung assuming the appearance of liver, arising from the overflow of nutritive function in the blood; it also sometimes is fragile, arising from the deposit of soft fresh lymph.

What is the colour of hepatized lung? — It varies with the quan-

tity of blood effused, sometimes being red, at others violet-coloured, and when opened it is granulated.

What is the condition in the third stage?—Yellow hepatization, or suppuration, has taken place.

What is the change in this stage?—The conversion of the lymph, &c., into a soft friable yellow matter, and finally into pus; the tissue loses its granular appearance, and becomes more smooth and polished; and by placing the lung under a stream of water, the parenchyma is removed, and nothing but the bronchial tubes remain, and these tubes contain purulent matter.

What takes place in the fourth stage? — The parenchyma is softened down and removed by expectoration, and an abscess remains, resembling an abscess in the other tissues of the body.

Does the patient recover when this stage has arrived? — Yes, generally, if the pus is in an abscess, instead of being diffused throughout the lungs.

Can pneumonia be local? — Yes; and then we have only a small portion of the lung affected denoted by the physical signs in the part, without, however, the general inflammatory symptoms.

How long do these cases usually continue? — From ten days to two weeks.

What is the prognosis? — Favourable.

What is the treatment? — Moderate bleeding, followed by cups to the part affected.

Into what may this affection pass if not watched? — Into phthisis.

May not pneumonia assume the *asthenic form?* — Yes.

When, and how does this occur? — It may be so from the commencement. In the third stage of ordinary pneumonia this occurs to a certain extent, if the suppuration has been diffuse.

What are the causes of its occurrence in the earlier stages? — Advanced age, previous debility, and certain epidemic causes.

Do the local signs or the expectorations differ in this type from the preceding? — No; except that it passes more speedily to suppuration, with little viscid expectoration.

How are the general symptoms? — Different from the other variety, inasmuch as we have a feeble pulse, diminished action in the capillaries, and great sinking in the strength.

What is apt to occur in the third stage? — Gangrene of the lungs.

What is the treatment of asthenic pneumonia? — Local bleeding may be used, but blisters are of chief benefit; and also the free application of counter-irritants.

What are some of the internal remedies? — Antimony should not, as a general rule, be used at all; and we must rely more upon opium, calomel, and ipecac.; and the opium should be used with caution.

Are stimulants of advantage? — Yes; and they may be used as in the third stage of the previous type, viz., wine whey, senega, &c.

In inebriates are alcoholic stimulants beneficial? — Yes.

Is carbonate of ammonia beneficial? — Yes; of great importance.

When the asthenic variety prevails as an epidemic, what name has been given to it? — Typhoid pneumonia; and then the patient often requires great stimulation.

What do you understand by lobular pneumonia? — It is that form of the affection occurring principally in young children, and where the disease is scattered over a large extent of the lung, attacking isolated lobules, leaving, for a time, the intermediate tissue in a healthy state.

What are the lobules generally affected? — Those at the posterior part of the lung.

What is the appearance of the tissue in this form of the disease? —It is much darker, harder, and smoother, and imperfectly granulated; and passes with difficulty to purulent secretion.

Does this affection confine itself to one lung? — Rarely; but the right lung generally suffers the most, and the bronchial tissues are more frequently inflamed than the pleura.

Does bronchitis accompany this disease sooner or later? — It is often the first lesion.

Where does the induration usually occur? — At the posterior portion of the lung, and surrounds the smaller tubes, and gradually advances; and in other cases the induration occurs rapidly, and modifies the type of the affection.

What are the physical signs?—At first those of ordinary bronchitis; and the percussion at first is clear, but becomes dull as the disease advances, and the dulness is not confined to one side; the respiration becomes not completely bronchial, but approaches this as the disease advances.

What is the state of the circulation? — The fever is sometimes intense, and the disturbance of the circulation extends to the capillaries; and the red circumscribed patch on each cheek, with the dilatation of the nostrils, form one of the best indications of the disease.

What are the accidental symptoms? — Those connected with the abdomen, brain, &c. The more important are the cerebral symptoms, which may sometimes mask the others.

Where lies the difficulty in diagnosis? — In making the dividing line between it and bronchitis, and also in distinguishing it from tubercles in the lungs.

What is the prognosis?—Favourable in the early stages, and where it is acute; but they become changed by complications of enfeebled health, or when it is secondary; but it is generally more unfavourable than in pneumonia proper.

What is the treatment? — It varies with the manner in which the disorder commences. If we have an acute disease, with oppression and high excitement, we must use the antiphlogistic treatment vigorously.

Is venesection ever necessary? — In a few cases, but leeching is preferable.

Are blisters much used?—No; but revulsives over a large surface are decidedly beneficial, as mustard poultices, &c.

What is the natural cure?—By secretion.

By what do you favour this?—By the nauseating expectorants, in combination with stimulant expectorants; vin. ipecac., lac. assafœt., and sometimes, by vomiting, when much mucus is secreted.

What is a very important hygienic precaution?—Not to allow the child to remain long in one position, but varying it every half hour.

Why is this precaution necessary?—To prevent congestion of the lungs by stasis.

What is the peculiarity of this disease when it attacks the aged?—To become latent, or lose the ordinary functional signs; and to run on to the second and third stage before anything of the kind is indi cated.

How would you manage such a case?—As in ordinary pneumonia, varying as a sthenic or asthenic type.

When there is an attack of pneumonia supervening upon any other affection of the lungs, what is it called?—Intercurrent pneumonia.

GANGRENE OF THE LUNGS.

How may this occur?—Either as a primary or secondary affection.

What are the probable causes in the two instances?—In the first, from altered condition of blood; and the second, from asthenic pneumonia.

What is the state of the tissue?—At first hard and congested in the midst of inflamed parenchyma, or else there is infiltration of thin serous fluid; and in the second stage the tissue breaks down, then the bronchial tubes slough off, and nothing is left but the vessels, which resist for some time the destructive process.

What is the condition of the sputa and breath?—They are pathognomonic of the disease—being both extremely fœtid.

What are the characteristics of the sputa?—There are two; the one consists of a thin liquid, like tobacco-juice, with now and then small pieces of gangrenous lung; the other of a grayish-yellow, pasty fluid—a mixture of pus and gangrenous fluid.

What is the third stage?—The formation of a cavity more or less extensive.

What occurs in a fatal termination?—The sputa is increased in quantity, and the patient sinks.

What occurs in a favourable termination?—A membrane circumscribing the cavity in the lung is formed, which protects the healthy portion of the lung; and it first secretes pus, but gradually assumes the character of a mucous membrane lining small tubes.

If there is no exit to the cavity, what occurs?—It becomes converted almost into a serous membrane, and may exist during the life of the individual.

What are the local signs? — Cough, expectoration, and fœtor of breath.

What are the physical signs? — Feeble respiration and moist rhonchus, and the percussion is either natural or slightly dull.

What occurs as the disease advances? — We have the signs of cavity developed.

What are the signs when cicatrization takes place?—Feebleness of respiration gradually diminishing; and if the liquid is discharged from the cavity in its early stages, we have cavernous respiration, and the resonance of the voice is clearer.

What are the general signs? — Fever, with a small, frequent, and irritable pulse; anorexia; diarrhœa from the swallowing of the fluid; the skin is leaden in hue, and sometimes great dyspnœa is present.

What is the prognosis? — Unfavourable.

What is the treatment? — Supporting and stimulating, requiring tonics and stimulants, and sometimes counter-irritants, with strong diet.

Has chlorine any beneficial tendency? — Yes; the sol. sodæ chlor. (Labarraque), is of great benefit, together with the free use of chlorine as a disinfector.

Is opium ever beneficial? — Yes; sometimes to prevent paroxysms of coughing; but it should be used with great care.

TUBERCULOUS PHTHISIS, OR PHTHISIS PULMONALIS.

What affection of the lungs is considered the most formidable, and least manageable? — Phthisis pulmonalis.

When is treatment of benefit in this disease? — In the forming stage.

In what light is phthisis pulmonalis to be viewed?—As a complex affection; the whole economy being vitiated, and the lungs principally affected.

Is not, most frequently, the pulmonary affection the first sign of a tuberculous diathesis? — Yes.

What is the essential character of tubercular phthisis? — The deposition of tuberculous matter, either primary or secondary, in the substance of the lungs.

What is the general character of a tubercle? — A white, opaque, or yellowish body, and when softened it is converted into a thick, pasty, yellow liquid, of a dull, yellow colour, and of a heavy odour.

What are the forms under which tubercles present themselves?— Under that of gray granulation, or miliary tubercles; gray tubercular infiltration; gelatinous infiltration; crude tubercle, and yellow tuberculous infiltration.—[*Wood's Practice*, p. 62.]

How does the matter find its exit?—By the ulceration of the delicate cellular membrane investing it, and by its communication by ulceration with a bronchial tube.

What is their chemical composition?—Albumen, and salts of lime.

Is it invariable that the tubercles soften and discharge by a tube? —No; they sometimes, when the patient's health is improved, become hard and dry; the watery particles pass off, and the earthy matter increases in quantity, and a calcareous mass is left in the place of the tubercle; or they may be entirely absorbed, and so the patient may entirely recovery.

Which is the most frequent variety of tubercle?—That which commences by gray granulation.

Where do tubercles generally commence?—At the summit and two sides of the lungs.

Is there any peculiarity in the process of cicatrization of a tuberculous cavity?—No.

What is the condition of the surrounding tissues?—Very various; if the case is purely constitutional, without previous local disorder, the tissue remains pervious; but if there has been inflammation, there is induration of tissue, evinced by a variety of colours, &c. At other times, we have infiltration of tubercle throughout the pulmonary tissue, forming miliary tubercles.

Are the appendages of the lungs affected?—Yes; the serous tissues and lymphatic glands.

What is the mode of attack of phthisis?—It varies as the affection is either acute or chronic. In the acute disease we have the usual symptoms of an inflammatory affection; and in the chronic we have a slow change in the capillary vessels. In the acute variety, the serous membranes are usually attacked first; and in the chronic, the mucous.

Is tubercle invariably caused by inflammation?—No; but inflammation may be one of the causes acting upon a tubercular diathesis or constitution.

Which of the pectoral affections most favour the development of tubercles?—Pleuritis.

Does bronchitis and pneumonia ever occur among the earlier lesions of phthisis?—Yes.

Is pneumonia a frequent cause?—No; it is the least so.

Does phthisis ever occur without accompanying inflammation? —Yes.

How would you divide the symptoms of phthisis?—1, into those proper to phthisis and other tuberculous diseases; 2, those apparent upon development of tubercles in the lungs and air passages; 3, symptoms of other organs.

What are some of the first class?—Extreme frequency of pulse, quick and jerking; fever continuing during the day, and increasing at night; sweating at night, thirst, anorexia, constipation; and, when fever is developed, we have a restless expression of countenance; light, circumscribed red spot upon the cheek, and emaciation; and,

in the more chronic cases, we have dulness of the skin, and burning in the palms of the hands and in the soles of the feet.

Is hectic fever a consequence of tubercles? — Yes.

What are the symptoms directly dependent upon the development of tubercles? — We have bronchial inflammation, cough in paroxysms, and in the last stages becoming feeble and cavernous in character.

What is the character of the expectoration?—At first very similar to bronchitis, and when the tubercles are softened they form a yellow expectoration of pus and softened tubercle, and nummular sputa.

Is there much pain in tubercle? — Not generally.

What are some of the physical signs? — At first we have vesicular inspiration harsh and feeble, and slightly puerile, and the expiration becoming louder and louder; and when softening occurs we have a slight rhonchus, passing through the various stages to complete gurgling, &c.

What is the percusssion? — We have dulness at the summit of the lung, and over the parts affected, increasing to flatness.

What is the appearance of the thorax externally?—It is contracted.

What are the symptoms dependent upon the accessary diseases of the lungs and air-passages? — We have bronchitis, pneumonia, pleurisy without effusion, laryngitis, tracheitis, and pharyngitis, all of which have a tendency to increase the symptoms of phthisis, by combining their symptoms with those of phthisis.

What are some of the symptoms arising from other organs than those of respiration? — Tubercular affections of the bowels, with diarrhœa, dyspepsia, fistula in ano, affections of the liver, heart, &c.

Is the diagnosis of phthisis difficult? — No, not when the disease is far advanced; but when the local signs are not well developed, or when it is masked by other affections, it is then difficult.

What are some of the signs of most value in early diagnosis? — Hemoptysis occurring before tubercles are developed, or when they are enclosed and few, and when cavities are formed; and the frequent occurrence of attacks of pleurisy; and the grouping together of other symptoms of lung affections.

What is the prognosis in this affection? — In a large majority of cases unfavourable, but there are many circumstances which may modify its result.

What is the general duration? — In acute cases it generally runs its course in a short time, while in the ordinary variety it may last for eighteen months or more.

Treatment.

What is the treatment? — It is in a large majority of cases only palliative.

What are the principal remedies upon which we rely? — Tonics

and alteratives; viz. iodine, preparations of sarsaparilla, and cod liver oil.

Is iodine of benefit if hectic supervenes? — No.

Have hygienic means any effect? — Yes; sometimes they are very beneficial.

In the management of this disease, to what should we direct our attention chiefly? — To the causes; as hereditary taint; the depressing causes upon the powers of life; certain occupations, as the various sedentary trades and professions.

Is change of climate beneficial?—Yes, and should be recommended early, before the disease has made much progress.

Which places are the most selected? — The West Indies, Madeira, south of France, Italy, and Florida.

What are some of the intercurrent affections which require our attention? — The bronchial and tracheal, causing irritation, and tickling, &c.; pneumonia, pleurisy, and laryngitis.

How are these affections to be treated? — As if uncomplicated, always bearing in mind the cause of them.

What other complications do we have? — Diarrhœa, hectic fever, night sweats, &c.

How would you treat them? — As in ordinary cases, modified by the existing phthisis.

Are opiates ever prescribed?—Yes; in small quantities, to produce sleep, &c.

EMPHYSEMA.

What is meant by this? — That affection of the lungs in which the tissue is morbidly distended with air.

What are the varieties of this? — That where the air cells are abnormally dilated, or vesicular emphysema, and that where the air escapes from the air cells, or extra-vesicular.

What are the symptoms of this disease? — When only slight, it is scarcely discernible by general signs; the physical signs, in more marked cases, evince an altered shape of the chest, with more rotundity and widening of the intercostal spaces; and in respiration the chest falls little, if any, during expiration. By percussion, we have a fuller and clearer sound than in health; by auscultation the respiratory murmur is feeble, if at all. We have also the dry and moist rales of catarrh, and sometimes a dry subcrepitant rale. In children however, the respiratory murmur is exaggerated.

What are the causes of this disease? — The vesicular variety is almost always chronic, arising from some cause which may produce great dyspnœa. In the extra-vesicular variety, any cause which may produce a sudden rupture of the air cells, may induce it.

Treatment.

What is the treatment in this disease? —When we have exacerbations of the dyspnœa, we must keep the patient quiet, and take away

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all exciting causes. If we find anything like bronchitis, congestion of the lungs, or any other complication, we must resort to cups between the shoulders, counter-irritants over the chest; sometimes the lancet, with pediluvia, using internally the alkalies, and anti-spasmodics and narcotics, and emetic expectorants. Afterwards direct the patient to avoid any exertion or exposure which might have a tendency to bring on an attack. A residence in a mild climate, of an equable temperature, is sometimes necessary.

CARDIAC AFFECTIONS.

PERICARDITIS.

What is pericarditis? — Inflammation of the pericardium.

What are the anatomical characters of acute inflammation of the pericardium? — Preternatural redness of the membrane, coagulable lymph adhering to its surface, and fluid effused within its cavity.

Why should these changes be accurately examined by the student? — On account of their affording the only definite clue to the various symptoms which occur in this formidable and fatal malady.

What are the general signs of pericarditis? — Acute inflammatory fever, (generally preceded by rigors), sometimes a pungent burning, lancinating pain in the region of the heart, shooting to the left scapula, shoulder, and upper arm; pain increased by full inspiration, by stretching the left side, and by percussion, and by pressure between the præcordial ribs, and forcing the epigastrium upwards underneath the left hypochondrium; in other cases the pain is more or less dull, and does not lancinate, or it is wholly absent, or is merely uneasiness, or patients may refer the pain to the epigastrium, or left hypochondrium, rather than to the præcordial region; the pain which is circumscribed, is increased by upward pressure, and in some cases, there is sensation of constriction over the left side, with oppression in the region of the heart, rather than acute pain. Inability of lying on the left side, or in any position, except upon the back; dry cough, accelerated respiration, palpitation of the heart, sometimes violent, at others feeble, fluttering, and intermittent; pulse frequent, and generally, at the onset, full, hard, abrupt, and jerking, but regular; and the character of the pulse varying as the disease advances; constrained position; great anxiety of countenance and mind; faintness; paleness; failure of animal heat; intumescence and lividity of face and extremities, from great obstruction to the circulation, &c.

May not pericarditis exist without any of these signs? — Yes, the above description is more applicable to the worst forms, and often the rational signs are almost entirely wanting.

What are the four signs upon which we can base a diagnosis of pericarditis? — Increased action of the heart; fever; and a murmur which did not previously exist; and dulness on percussion; and to these may

be added the circumstance whether the patient is affected with acute or subacute rheumatism.

What is always an excellent rule in examining patients labouring under any severe inflammatory or febrile affection?—To place the hand upon the præcordial region as well as on the pulse, (this prevents a mistake should the disease be masked).

What diseases may obscure our diagnosis?—Pleurisy and pneumonia; but the treatment in these cases would not be varied.

What are the signs of amelioration in this affection?—The decline of the feeble, fluttering, unsteady pulse, and impulse of the heart, and feeling of faintness and suffocation, and the constrained position, and a diminution of morbid sounds, extensive dulness on percussion; and if the pain should be mere diffuse uneasiness, or wholly cease; decrease of anxiety; murmur of attrition inaudible; vehemence of heart's action decreasing, &c.

What are the physical signs?—Dulness over a greater extent than natural, in proportion to the fluid effused, respiration absent when the præcordial region is elevated; undulatory impulse; the first sound and murmurs of auricular valves more obscure than natural; second sound heard high up the vessels as distinct as natural; impulse of the heart, at first increased and abrupt, but when there is much serous effusion, the impulse is feeble, faltering, irregular, and unequal, and when pericarditis is complicated with aortic regurgitation from endocarditis, the pulse is peculiar, and often accompanied with a thrill and jerking. Friction sounds occurring when effusion is slight; first, near the base of the heart; or if lymph alone is effused; or when absorption has taken place of effused fluid, or when the effusion of lymph is local, the murmur exists over that spot alone.

Does not adhesion of the pericardium to the heart sometimes occur?—Yes.

What are some other murmurs which may be presumptive evidence of pericarditis?—Those proceeding from valvular affections occasioned by co-existent inflammation of the lining membrane of the heart, which almost always accompanies pericarditis.

CHRONIC PERICARDITIS.

What are the general signs of chronic pericarditis?—Much the same as in the acute variety, but less in degree.

When we have chronic pericarditis from the commencement, are not the symptoms very obscure?—Yes.

What are the physical signs?—The impulse is (cæteris paribus), weaker than in the acute variety; if hypertrophy exists the impulse will be modified, and the sounds vary according to circumstances.

What are the causes of pericarditis generally?—Blows, wounds, punctures, pressure over the præcordial region, inflammation propagated from the lungs or pleura; and above all others acute rheumatism, and the other causes of inflammation in general.

Who are most liable to this affection?—Those between the ages of eight and thirty-five.

How soon may pericarditis run its course?—If intense or extensive, or complicated with endocarditis, or pleuritis, it may prove fatal within thirty or forty hours; but when vigorously treated, it generally terminates favourably in a week or ten days; and chronic pericarditis, whenever established, may run several weeks, or, if neglected, several months.

What are the terminations of pericarditis? — Resolution, adhesion of the pericardium, chronic pericarditis, and valvular disease when complicated with endocarditis.

What is the prognosis of pericarditis?—When the disease has been detected early, and the treatment vigorous from the commencement, it is favourable, and when valvular disease occurs, it will vary according to the situation and extent of the affection, and the ultimate prognosis is unfavourable when adhesion of the pericardium has taken place, or when with effusion it has become chronic; and, from all the circumstances taken in connexion, we may place endo-pericarditis as a decidedly dangerous affection.

Treatment.

What should be the treatment in acute pericarditis? — Antiphlogistics vigorous from the commencement; bleeding copiously, both locally and generally; purging freely; and bringing the patient speedily under the influence of mercury; diluent cooling drinks, and diet of the weakest kind, and perfect rest; and if necessary, blisters over the heart.

Are not those who have recently been affected with pericarditis, liable to a recurrence of it?—Yes; especially when liable to rheumatism.

Are not patients frequently benefited by a sedative? — Yes; particularly hyoscyamus and digitalis.

What is necessary in chronic pericarditis? — Counter-irritants over the heart; as blisters kept open by savine cerate; slight mercurialization; and if dropsy should supervene, the usual diuretics; the diet may consist of light animal food and broths. — [*Hope on the Heart*, by Pennock].

ENDOCARDITIS.

What is endocarditis? — Inflammation of the lining membrane of the heart.

To what does this give rise? — To the greater number of valvular diseases of the heart, and indirectly to alteration in the muscular structure.

What are the anatomical characters of acute endocarditis? — Redness of the internal membrane of the heart and arteries; an effusion

of lymph or pus on its surface, and thickening, softening, and ulceration of its substance, and of the subjacent cellular and fibrous tissues; and according to M. Bouillaud, the presence of adherent colourless coagula of the blood. (We must always bear in mind that redness may be inflammatory or not, and is difficult to be determined, and consequently, is one of the most fallacious signs).—[See *Hope*, by Pennock].

What are the general signs?—Inflammatory fever exists to a greater or less extent; but its symptoms may be suspended when great embarrassment of the circulation supervenes, and is replaced by symptoms of orthopnœa, pain is present to a limited degree, sometimes amounting only to weariness, and the circulation is modified by the free or obstructed passage of the blood; when the circulation is free the action of the heart is violent and abrupt, and is felt of a greater extent than usual; the pulse is strong, full, hard, and regular; as a general rule, generally between 80 and 110 in a minute; aortic regurgitation renders it jerking; respiration is slightly accelerated on motion; there is no purpleness, œdema, or cold limbs, (notwithstanding the mildness of these symptoms, the ultimate results may be dangerous).

When the circulation through the heart is impeded from any cause, what are the signs?—The action of the heart is irregular, unequal, and intermittent, and exceedingly quick, from 130 to 160 in a minute, sometimes beats are dropped in the pulse which exist in the heart, the pulse is sometimes violent, becoming afterwards feeble, and fluttering from exhaustion. The pulse is generally small, weak, irregular, unequal, and intermittent; and this may be the case though the impulse be violent and tumultuous; and if there is aortic regurgitation, the pulse will be jerking; there is present on this account paleness, coldness, faintness, anxiety of mind and countenance, great feeling of suffocation; the hands become purple, and if the patient survives a few days, dropsy of the face and lower extremities may occur; the mind may wander, &c.

May not some of these symptoms exist temporarily, and in a moderate degree, without any mechanical obstruction related before?—Yes; but then the physical signs will soon reveal the cause.

What are the physical signs?—Percussion; dull over the surface of 4–9 and 16 square inches, but this sign is absent when the circulation remains free. The impulse is violent, abrupt, and regular, as long as the circulation is free, but when it is greatly impeded, it may continue violent; but is an irregular confused tumult; and this violence subsides into a pulse unequal and fluttering as the obstruction increases, and the nervous power fails. If the inflammation has caused constriction of either set of valves, or permanent patency of either auricular valve, allowing regurgitation, a murmur will attend the first sound, so also the passage of blood at the aortic orifice and mitral valve, and may proceed from the sigmoid alone, the auricular alone

or both conjointly, if the inflammation has caused permanent patency of either set of sigmoid valves, allowing regurgitation; a murmur will attend the second sound, seldom heard from contraction of the auricular.

What is the termination of a great majority of cases of endocarditis? — In recovery, if treated vigorously at the commencement; otherwise serious organic affections of the valves will take place.

What are the causes of endocarditis? — Those of pericarditis, to which phlebitis extending to the heart may be added.

What is the treatment of endocarditis?—That of pericarditis, and no less vigorous; mercury is beneficial, and counter-irritation, and quiet; beyond this we use the same as in valvular disease. — [*Hope*, by Pennock].

Is not rheumatism a frequent cause of endocarditis? — Yes.

HYPERTROPHY OF THE HEART.

What do you understand by hypertrophy of the heart? — Augmentation of the muscular substance of the heart, resulting from increased nutrition.

What are the varieties of hypertrophy?—Simple hypertrophy, when the walls are thickened, the cavity retaining its natural dimensions; 2. Hypertrophy with dilatation, or eccentric, when the walls are thickened and the cavity dilated; or with the walls of natural thickness, and cavity dilated; 3. Hypertrophy with contraction, when the walls are thickened and the cavity diminished, or concentric hypertrophy.

In speaking of the preponderance of hypertrophy or dilatation in the heart, how would you convey the idea whether hypertrophy or dilatation was in excess? — By placing the term which denotes the more excessive derangement first; as: hypertrophy with dilatation, in case of the hypertrophy being greater, and *vice versâ*.

What, in general terms, is the size and weight of the heart? — It should be a little less or a little greater than the fist of the patient, and in absolute weight after puberty 9 ounces.

What are the anatomical characters of hypertrophy? —In persons of vigorous health, blood rich, and nutrition active, the muscular structure becomes redder and firmer than usual. In the leucophlegmatic and the cachectic, the muscular structure is relaxed, flabby, softened, and is then associated with dilatation; shreds of loose laminæ, of a dirty white colour, are mixed with the substance of the heart; sometimes the structure contains fat, and sometimes the whole ventricular parietes have become a dense fibrous tissue.

May not hypertrophy affect one part of the heart, and not another, at the same time? — Yes.

How may hypertrophy occur in the heart? — Sometimes independent of inflammation, by an increased action in the part causing an augmented afflux of blood, and increased nutrition of the heart.

What are the exciting causes of hypertrophy? — Any violent, nervous, or mechanical excitement, kept up for a length of time, or frequently repeated.

How are the pathological effects of hypertrophy modified? — By the degree of hypertrophy, the part it affects and the other lesions with which it may be complicated. When the left ventricle is more particularly implicated, we have derangement of the general circulation, and its functions, producing apoplexy, pleuritis, &c.—(*C. I. B. Williams's Lect.*)

What are the general signs of simple hypertrophy? — Palpitation, dyspnœa, followed by dropsy; there is generally not much cough. Hæmoptysis is rare; the pulse varies as dilatation is present or not, and the part in hypertrophy affected; there is a sensation of a rush of blood to the head, with the attendant feelings; the complexion is heightened. Serous infiltration late in the disease, angina cordis, &c.

What are the physical signs?— The percussional dulness and situation of the impulse will vary according to the form of the dilated hypertrophy, and circumstances which affect the position of the organ; a strong slowly-heaving impulse is the chief sign of simple hypertrophy, followed by a diastolic impulse; in hypertrophy with dilatation, the contraction of the ventricles can be felt by the hand over the præcordial region in smart violent shocks, with general increase in the heart and arterial action. (See *Hope*, by Pennock, for the various impulses.)

What effect has hypertrophy upon the sounds of the heart? — It deadens the sounds of the heart.

What is the effect in hypertrophy with dilatation? — The sounds are increased to their maximum, being louder than in any other disease of the heart, especially during palpitation.

What is the condition of the resonance of the præcordial region?— It is deficient in simple hypertrophy, but much more so in hypertrophy with dilatation (emphysema counteracts dulness, and should be particularly noticed).

Is there much prominence in the præcordial region? — Yes.

Is hypertrophy, when moderate and uncomplicated with any mechanical impediment to the circulation, productive of much inconvenience? — No.

What circumstances may vary the development of the effects of hypertrophy? — The form of the disease, its complications, the nature and intensity of the exciting causes, and the constitution of the patient.

What is the prognosis in hypertrophy? — It varies. In the early stage it is favourable, but in the more advanced stages, especially when dropsy supervenes and recurs, and the patient is old, it is unfavourable.

What is the treatment in hypertrophy? — Remove all exciting causes, regulate the diet; at first small quantities of blood should be

abstracted generally and frequently, according to circumstances; local depletion may be adopted, especially in the interscapular region; purgatives should be used in conjunction with bleeding, so also diuretics; watch the condition of the stomach and liver; and should there much nervous irritability exist, digitalis, tinct. gtts. xx–xxx., twice or thrice a day. Iodine is also beneficial on account of its absorbing properties, and the extr. hyos. conium, belladonna, camphor, and assafœtida, are highly useful in dyspnœa, and the paroxysmal palpitation. [*Hope*, by Pennock.]

DILATATION OF THE HEART.

What is meant by dilatation of the heart? — Amplifications of one or more cavities.

What are the varieties of dilatation?—Dilatation with hypertrophy, when the cavity is enlarged, and the walls thickened; simple dilatation, when the cavity is enlarged, and the walls of their natural thickness; dilatation with attenuation, in which the cavity is enlarged and the walls attenuated.

From what does dilatation arise? — From the mechanical effect of over-distension—the patients generally having thin-walled hearts, or the heart becoming flabby from emaciation, anæmia, &c.

What are the causes of dilatation?—1. Deficient power in the heart in proportion to the system, whether acquired or congenital; 2. All obstructions to the circulation, whether situated in the orifices of the heart, or in the aortic or pulmonary system.

What are the general signs of dilatation? — The palpitations are feeble and oppressed; distressing frequent and protracted; the pulse is soft and feeble; there is languor in the arterial circulation, causing chilliness of the extremities, &c.; difficult respiration, cough, passive pulmonary hemorrhage of dark, grumous blood; there is great venous engorgement, causing serous infiltration; discolouration of the face; congestion of the brain; injection of the mucous membranes; passive hemorrhage; congestion and enlargement of the liver; and, sometimes, angina of the heart.

What are the physical signs?—These vary with the particular part of the heart affected; the impulse is generally diminished, and the sounds are louder; the resonance over the præcordial region is diminished by dilatation, &c.

What is the prognosis in dilatation? — In the simple form it is not very formidable; but when we have an increase in dyspnœa, and that recurring, it is more unfavourable; and when dropsy supervenes, or we have a constant tendency to it, the patient eventually sinks. Dilatation with attenuation, and softening, is the most destructive form.

What should be the treatment in dilatation with attenuation, and sometimes with natural thickness? — Remove all exciting causes; restrict exercise, diet, &c.; improve general health by bitters, mineral acids, chalybeates, &c.; guard the lungs and bronchi from all inter-

current inflammations; do not resort to bloodletting during a paroxysm of dyspnœa; but immerse the extremities in warm water, promote perspiration, allow free access of air, administer an antispasmodic, &c. —[*Hope*, by Pennock.]

[For a full and careful history, causes, treatment, &c., of all the affections of the heart, we must refer the student to the edition of *Hope on the Heart*, by Dr. Pennock, Pa., 1842, to which we are indebted for most of the observations here made.]

PHLEGMASIÆ OF THE ALIMENTARY CANAL AND ACCESSORY ORGANS.

GLOSSITIS.

What is glossitis? — Inflammation of the tongue.

When it occurs idiopathically, what are its causes?—Any irritating substances taken into the mouth, or wounds of the tongue from any cause, &c.

Is not idiopathic inflammation of the tongue a rare disease?—Yes.

When it does occur, what are the local symptoms? — It becomes painful; the surface is first red, but soon becomes coated, except at the tip and margin, with a white, viscid mucus; articulation and deglutition is impeded; saliva dribbles from the mouth; the enlarged state of the organ impedes the respiration; cough is present; as the swelling increases it is protruded from the mouth, and there is evident engorgement of the vessels of the head, with all the attending symptoms.

What are the constitutional symptoms? — These are influenced by the local affection, in the onset of the disease; the pulse is frequent, full, and hard, but changes as the disease advances, and becomes smaller and weaker when the respiration is much impeded; the secretions are generally stopped, and the patient labours under great restlessness and nervous irritability.

When glossitis occurs symptomatically, what are the symptoms?— Those of the idiopathic variety greatly modified.

What diseases does glossitis sometimes accompany? — The exanthematous fevers; and it may arise from the continuity of inflammation attending neighbouring organs.

How may glossitis terminate? — Either in resolution, suppuration, or gangrene; rarely however in the latter.

Should the treatment in the idiopathic variety be prompt? — Yes; very.

On what must we depend? — Bloodletting, generally and locally; incisions from the base to the tip of the tongue; ice to the tongue, and blister to throat and neck; cathartics both by the mouth and anus; and sometimes we must resort to tracheotomy; and if suppuration occurs, an exit for the pus should immediately be made.

PAROTITIS.

How do you divide this affection?—Into the specific and common

What is the specific variety vulgarly called?—Mumps.

What are the symptoms?—Pain in one or both parotid glands; slight febrile excitement; fulness at the angle of jaw, and extending to neighbouring parts.

When does it subside, and what then may occur?—It usually subsides in five to nine days, and then metastasis may take place to the mammæ, testes, or to the brain.

What is the general cause for specific parotitis?—Contagion; and it occurs generally but once in one's life.

What is the treatment?—Keeping the bowels open, the parts warm, and regulating the diet.

What should be done with the secondary affections?—Treated as if idiopathic.

What does the common variety usually result from?—Exposure to cold.

What are the symptoms?—Those of the specific variety, though often running higher.

Do we ever have a form arising from scarlatina?—Yes; and then the swelling is hard and indolent, and extends to the glands of the neck.

What is the treatment?—As antiphlogistic as the strength of the patient will bear, together with warm local applications.

CYNANCHE TONSILLARIS, OR TONSILLITIS.

What is the common name of this affection?—Quinsy.

What is the character of the affection?—Inflammation, either superficial or deep-seated, of the tonsils.

What are the symptoms?—Fulness in the throat, pain and difficulty of swallowing, heat and dryness of the fauces, and shooting pains, and the voice is croaking.

What is seen upon inspection?—We find the tonsils swollen and red, and projecting into the throat.

How long may these symptoms continue?—Several days, and either terminate in resolution or in passive congestion, or in suppuration, rarely in gangrene.

Is there much fever?—Yes; generally.

What are the causes of tonsillitis?—The usual predisposing causes of the other phlegmasiæ.

Is it ever fatal?—Yes; when there is pressure on the larynx obstructing respiration, or causing difficulty in taking food, for a length of time.

What is the treatment?—Antiphlogistic; emetics, bleeding, cathartics, and incisions in the tonsils, especially if pus is formed.

Are local remedies beneficial?—Yes.

What is hypertrophy of the tonsils?—An indolent enlargement of these organs without pain.

In whom do we most generally find this?—In those of strumous habit.

What is the treatment?—Leeching, scarification, blisters, &c., and, finally, extirpation; and sometimes nitrate of silver has been used with advantage, and the iodide of zinc, recently as local applications.

DISEASES OF THE ŒSOPHAGUS.

Is this liable to disease?—Not often.

What may excite inflammation?—Acrid poisons, or continuation of disease from the fauces, pharynx, and stomach.

What are the most important alterations of structure?—Hypertrophy of the submucous cellular tissue, carcinoma, compression from tumours, &c.

How is spasmodic stricture characterized?—By difficulty of swallowing, and that being felt in the upper part of the œsophagus, and coming and going frequently.

Who are most subject to it?—Nervous persons.

Is the diagnosis of this form of the affection of importance?—Yes; especially to distinguish it from organic derangement.

What is the treatment?—To lesson morbid irritability, by cold sponging, blister to the nucha, and antispasmodics, introduction of the bougie, &c.

When we have previous debility, what is best?—To restore the strength of the patient by tonics, fresh air, &c.

GASTRITIS.

What is gastritis?—Inflammation of the stomach; but the term is generally used to denote inflammation of the mucous membrane alone.

What are the symptoms?—Fever, with intense pain and burning, extending to the œsophagus; and increase of pain by pressure on the stomach, or by inspiration, or swallowing, or vomiting; accompanied by nausea, vomiting, great thirst, fulness in the epigastrium, and increase of heat is felt when the hand is placed over the stomach; there is much prostration present.

How is the pulse?—Frequent and small, soon becoming weak and thready.

How are the bowels and urine?—The bowels are constipated, and the urine is scanty and high-coloured.

How is the tongue?—Red along the edges and at the top, and covered in the middle with flaky fur.

With what may this disease be confounded?—With peritonitis; but it may eventually be distinguished by the seat of pain, peculiar thirst, burning in epigastrium, &c.

When does the disease terminate? — It may terminate in a few hours, or last some weeks, and degenerate into the subacute or chronic form.

What are the symptoms of subacute?—Pain and uneasiness in the epigastrium, with the usual signs of the tenderness on pressure, anorexia, nausea, sense of distension, flatulence, eructations, thirst and dryness of the mouth, &c.; the tongue is red at tip and margin, and covered over the whole surface with elevated papillæ.

What is the condition of the bowels, skin, &c.? — The bowels are sluggish, the skin is dry, and the urine high-coloured.

What are some of the sympathetic disorders? — Fever, headache, cough, and pains in the limbs, &c.

How long does it generally last? — Sometimes many months.

What are the symptoms of chronic gastritis? — They are very similar to the last variety, but it has a greater number of sympathetic affections.

Mention some of the symptoms peculiar to it? — Constant tenderness, vomiting of glairy fluid, gnawing pain, feelings of vacuity, irregular appetite, acidity, flatulence, palpitation, &c.

What is the condition of the intestines? — Torpid; and the urine is of various hues.

What is the condition of the skin? — Dry and harsh.

Does the nervous system suffer? — Yes; and with the most varied diseases.

Do the thoracic organs sympathize? — Yes.

How may death be caused?—By general exhaustion; but in many instances by the complications of disease in the liver, kidneys, and lungs.

What are the anatomical characters of gastritis? — We have a contracted and wrinkled mucous membrane, with varied degrees of redness in the different parts; and in the chronic variety we have hypertrophy of the mucous tissue, with brown, gray, and chocolate tints, and the follicles more developed than natural.

What are the causes of the different varieties?—The usual changes in the weather, irritants of various kinds, errors in diet, sympathetic inflammation; and in the chronic variety it may arise, besides, from positions of the body, as stooping, &c.

What is the treatment of the acute variety? — If poison has been taken, we must use the antidotes, &c.; if from other causes, the antiphlogistics; sometimes bleeding, but chiefly leeching, repeated cupping, anodynes, mucilaginous drinks, ice and iced drinks, cold arrow root, &c.

How must we act upon the bowels? — By enemata.

Are the preparations of mercury beneficial? — Sometimes.

Are external applications of service? — Yes.

What is necessary in the subacute variety? — It may be treated on the same general principles as the acute.

What is necessary in the chronic variety? — Local depletion, farinaceous diet, counter-irritation, as blisters, ol. tiglii, Burgundy pitch plaster, and anodynes; and a carefully-conducted course of mercury.

Must the bowels be regulated? —Yes; and we may use, for that purpose, castor-oil, Rochelle salts, manna, &c.

What are some of the remedies which have seemed to possess a peculiar influence in the chronic variety?—Argt. nit., bismuth trisnit., ol. terebinth., tr. benz., creos., ferri. sulph., quinia sulph., acid hydrocyan. medicinal.

Is warm bathing beneficial? — Yes, sometimes.

ORGANIC DISEASES OF THE STOMACH.

CARCINOMA OF THE STOMACH.

What is the appearance in carcinoma of the stomach? — That of an indurated, fibrous, semicartilaginous formation.

Which part does it most frequently attack? — The pylorus.

What is the state of the mucous membrane? — Thickened and indurated, or partially ulcerated; and this ulceration sometimes perforating the coats of the stomach.

What other form does it assume? — The cephalomatous, collected in masses, and growing from the submucous tissue.

What is still another form? — Where the parietes are thickened, and where a section shows a number of little cells, having fibrous septa, and containing a glue-like matter.

Are neighbouring organs involved? — Yes, frequently.

What are the symptoms? — Pain, of a burning kind, and gnawing; acid or bitter eructations; at first vomiting ingesta, and afterwards ropy or shreddy substances, and sometimes of blood or sanious matter.

Have we constipation? — Yes, at first; and this is generally succeeded by diarrhœa, and extreme emaciation.

What is the appearance of the countenance? — That of a cancerous diathesis.

Are these signs certain? — Not always.

What disease are we apt to confound with this?—Chronic gastritis with ulceration.

What is the diagnosis where the cardiac orifice is affected? — The pain and vomiting occurs immediately after food is taken, and there is also a feeling of impediment in deglutition.

What is the progress of cancer of the stomach? — Slow.

What is the cause of cancer of the stomach?—A peculiar diathesis.

Is there any cure for carcinoma? — No; but we may palliate the disease and retard its progress.

How would you favour this? — By proper diet, as milk and broth, and by perfect rest.

What anodynes are beneficial? — Morphia, prussic acid, opium, hyosciamus, conium, belladonna, &c.

SOFTENING AND ULCERATION OF THE STOMACH.

From what may this result? — From inflammation.

May not softening after death be mistaken for the effect of disease before death? — Yes.

Is not this subject still in great obscurity? — Yes.

What are the varieties of ulceration of the stomach? — Those of slight erosion, minute ulcers of the follicles, and ulcer penetrating the muscular and peritoneal coats, &c.

Which varieties are the most common? — The first two; and they have the symptoms of chronic gastritis.

What is the peculiarity of the third variety? — That it is quite latent, until perforation suddenly takes place.

Should hematemesis occur in chronic gastritis, or if there is a dark, pitchy appearance in the matters vomited, what should we suspect? — Ulceration.

What is the treatment? — Dietetical and palliative, and the careful administration of sedatives.

If ulcerations are not extremely large, how are the symptoms? — Very obscure.

What may perforation be caused by? — Simple ulceration, beginning either in the mucous or serous coat; carcinomatous ulceration, and gelatiniform softening.

Is it necessary in every perforation that the contents escape in the cavity of the abdomen? — No; for the stomach may adhere to neighbouring organs, and thus prevent it; but when it does occur the symptoms of sudden and violent peritonitis set in.

DYSPEPSIA.

What is the meaning of this term?—It is derived from δυσπεπτεω, to digest with difficulty; or any derangement of that function by which the aliment is converted into chyle.

What are some of the causes of this disease?—1st. From plethora or anemia; 2d, from the stomach sympathizing with other organs; and 3d, from deranged nervous action, &c.

What is the most simple form? — Acute dyspepsia, or indigestion.

What are some of the symptoms? — Anorexia, feeling of weight and fulness at the epigastrium, nausea, and eructations of bitter or acrid fluids, or gaseous matters, pains in the loins and limbs, dull headache, incapacity of thought, with despondency.

What is the condition of the tongue, skin, &c.? — The tongue is sometimes white, loaded with a thick, white, pasty fur; the skin is cool, pulse small and soft, face pale, and the eyes dull and heavy.

What are the most usual causes? — Excess in eating when the stomach is debilitated, or eating indigestible articles, great bodily fatigue, mental exhaustion, intemperance, broken rest, &c.

What is the treatment? — An emetic at first to clean the stomach,

then a dose of aperient medicine, followed by a vegetable aromatic tonic, and abstinence from solid food.

What are the peculiarities of that form of the disease when a discharge of bilious matter takes place? — In addition to the symptoms before enumerated, we have more general disturbance of the system, the matters vomited are bitter, and of a yellowish-green colour, the vision becomes dull, with tingling or prickling in the hands, noises in the ears. The face and the conjunctiva are of a yellow or muddy tint.

What is the course of this variety of the disorder? — In addition to those of the preceding variety, we have regurgitation of the bile from the duodenum into the stomach.

What is the treatment for this variety? — Slight emetics, followed by a dose of blue pill; or, if necessary, use clysters; and if the nausea continue, use effervescing mixtures, with a little brandy, or tinct. opii, counter-irritation, &c.

CHRONIC DYSPEPSIA.

How would you divide the symptoms of this affection?—Into local and general.

What are some of the local signs? — Impaired appetite, or absolute want of it, disgust for food, excessive appetite, perverted appetite, pains after eating, feelings of sinking or fulness, vomiting, cramp, hiccup, flatulence, ejection of acid, acrid, or bitter fluid, and sometimes of glairy fluid, called water-brash.

What are the general symptoms? — These are very various, and assume protean forms. The principal are, however, irritability of temper, oppressed intellect, senses dull, with wandering pains, itching, noises in the head, headache, oppressed breathing, palpitation; the bowels are sluggish, the urine is variable in colour, chilliness over the surface of the body, unrefreshing sleep, countenance dejected, &c.

What are the causes? — Any of the usual debilitating causes, as loss of blood, dejection, luxuries largely indulged in, &c.; irregularity in taking food, change of diet, crude fruit, &c.

Is the pathology of this affection well understood? — No; but we may presume that it arises from an insufficiency or impairment of the gastric-juice, with or without an atonic condition of the muscular fibres of the stomach.

How is the treatment to be regulated? — By imparting tone to the stomach, and removing urgent symptoms.

How would you answer these indications? — By the administration of an emetic, if the stomach is overloaded, or there is much nausea present, (if circumstances do not prevent it, such as pregnancy, &c.), and then following it with a blue pill, in combination with an antispasmodic, and afterwards prescribe tonics and alkalies, beginning with the milder vegetable tonics, and at the same time keeping up a

slight counter-irritation over the stomach, and regulating the diet, exercise, &c.

What are some of the remedies which have been found of especial importance in chronic gastritis? — Aqua calcis, creasote, bismuth subnit., argenti nitratum, the mineral acids, and in some cases the various preparations of iron, strychnia, and the various mineral waters.

Can we, *à priori*, judge of the particular articles of diet, suitable to each individual case? — No; but we may, as a general rule, order the farinaceous articles, and afterwards wild game, &c.

What are the particular symptoms which sometimes require particular attention? — Flatulence, heartburn, nausea and vomiting, palpitation.

How would you counteract these symptoms? — In flatulence a carminitive water, or spts. ammon. assafœt., spts. æth. comp., a drop or two of creasote in lime-water, or the oleum terebinth in emulsion, or Hoffmann's anodyne, are beneficial. In heartburn, the various alkalies, or sometimes the mineral acids, as the stomach is acid or alkaline, are used. In nausea and vomiting, the effervescing draught or the neutral mixture, or carbonated water, or the carbonate of magnesia, or undiluted brandy, in ʒj. doses; lime-water and milk, a tablespoonful of each, or hydrocyanic acid, or ice; abstinence from food or drink, and counter-irritation over the stomach. And in palpitation, purgatives combined with antispasmodics, as valerian, castor, morphia, and hyosciamus, are of service.

What organs are often sympathetically or consecutively affected? — The intestines, the liver, the organs of respiration, producing spasmodic, catarrhal, and organic affections; the heart, the brain, the spinal cord, and the skin.

GASTRALGIA AND ENTERALGIA.

What is the meaning of the term gastralgia? — Pain in the stomach.

What is the peculiar character of the pain? — Acute and capricious in its accessions; and it extends also to the neighbouring parts, as the left side, between the shoulders, &c.

What are some of its other peculiarities? — Little, if any, fever, the tongue is clean, bowels are costive, temper irritable, and captious; and there is headache, neuralgic pains in the bladder and rectum, and generally we have great despondency.

What sometimes complicates this affection? — Chronic gastritis.

What appears to be the nature of this affection? — Alteration in the function of the gastric nerves.

Who are the most liable to this affection, and what are the exciting causes? — Females; and it may arise from deficient food, anemia, and affections inducing great nervous susceptibility.

What are the exciting causes? — Those acting locally upon the stomach—as the use of indigestible food, stimulant potions, cold drinks; and, when the predisposition exists, an attack may be produced by the most trifling circumstances.

What is the plan of treatment? — To subdue local irritation by narcotics, as prussic acid, morphia, henbane, hops, &c.; and last, though not least, argt. nitratum internally, bismuth, in from gr. iii. to xiv. gr. doses.

How would you prevent a recurrence of the disease? — By due regard to diet.

What is necessary in cases where the general habit is affected? — This is difficult to mark out in this work, depending, as we must, upon the peculiar susceptibilities of the patient; but we may prescribe gentle exercise in the open air, avoid all excitants to the nervous system; and, in fact, adopt all the rules of correct hygiene.

What is the character of enteralgia? — Generally neuralgic.

From what may it arise? — From irregular action in the bowels, and from disorders of secretion, or from any of the usual exciting causes of gastralgia.

What is the treatment? — A dose of oil, and tr. opii, camphor, anodynes, and antispasmodics, and a general regulation of the nervous system.

GATRORRHŒA.

What do you mean by gastrorrhœa? — Functional disorder of the stomach, where we have ejection of fluid by vomiting, or eructation, as the chief symptom.

What is the character of the fluid? — Thin, glairy, and insipid, and it is sometimes as much as a pint in quantity.

What is it called when we have pain or burning accompanying the discharge? — Pyrosis, or water-brash.

What are the causes?—The use of vegetable food, especially when combined with alcoholic drinks.

What is the nature of this affection? — A catarrh from the mucous membrane of the stomach.

What is the treatment? — The diet must be firm and dry, chiefly animal food; and a resort to the various stomachic remedies, and sedatives must be made, &c.

What are some of the remedies of high reputation? — Bismuthi subnitras, nitric acid in infusion of columba, argt. nit. gr. i., twice or thrice daily; tr. benz. comp., &c.

DUODENITIS.

What are the anatomical characteristics of this disease? — Similar to those in inflammation of the stomach and ileum; the glands of Brunner and Peyer being also very much enlarged.

Are the symptoms of acute duodenitis well marked? — No; there is most generally jaundice present, but this is not always the case.

What are the symptoms of the chronic variety? — These are also very obscure; but we may suspect something of the kind, if pain is not felt till two or three hours after taking food, and from the tenderness being seated between the right hypochondrium and mesial line.

What are the symptoms of duodenal dyspepsia? — Those of the same affection of the stomach, but having more hepatic symptoms present.

What is the treatment of this affection? — Upon the same general principles as those of gastritis, and we must choose aperients, which act more particularly upon this portion of the intestinal canal, as senna, sulphur, castor oil, neutral salts, and blue pill, and sometimes croton oil in minute doses.

Should we suspect mucus in the intestine, what is found an excellent remedy? — Lime water.

Can duodenitis, under any circumstances, be easily recognised as a simple disease? — No; it more frequently exists in connection with gastritis.

ILEO-COLITIS, OR ENTERITIS.

What is meant by this term? — Inflammation of the ileum and colon.

What are the two parts affected? — The villous coat, and the follicular; the former arises from common causes, the latter appears to be subsequent to specific inflammation.

What are some of the anatomical characters of acute ileo-colitis? — We have inflammation of the follicles, presenting a button-like, pustular appearance; while, in inflammation of the glands of Peyer, we have an elliptical arrangement, made more manifest by their distended state.

May not one set of glands be affected while another entirely escapes? — Yes.

What are the peculiarities in the villous membrane, independently of the follicles? — We have redness, softening, abrasion, hypertrophy, and sometimes an uniform blackness, like gangrene.

In what disease do we find the glands of Peyer the most diseased? — In typhoid fever.

Is this affection in its simple form dangerous? — No.

What is the general appearance in ileo-colitis? — Patches of redness, with coatings of lymph, tough mucus, pus, irregular ulcerations, &c.

Does acute enteritis ever occur as a primitive disease? — Seldom.

When we have this affection arising from typhoid fever, what is the peculiarity of the affection? — The lesion extending to the cellular rather than to the mucous tissue.

What is seen in the chronic variety? — In addition to the signs of

the acute we have also induration, and brown and slate-coloured tints, contraction of the intestine, &c.

Does ulceration ever extend deeply?—Yes; but in this respect there is great variety.

What are some of the symptoms of acute and subacute ileo-colitis?—We have pain, of a dull, griping character, about the hypogastrium and right ilium, tenderness on pressure, and diarrhœa; the stools are thin and feculent. Fever is present, the skin moist, pulse soft, urine scanty, and high-coloured, tongue red at tip and edges, and furred in centre; and, in severe cases, the crust on the tongue is brown or black, the eyes dull, and in a typhoid form, the cerebral symptoms mask the abdominal disease.

What are some of the signs in the typhoid variety?—Meteorism, enlargement of spleen, anorexia, fauces inflamed, headache, epistaxis, rose-coloured spots, great heat, &c., of the surface.

What is the duration and mortality?—The duration is twenty-five days, and mortality small.

What is a standing sign in chronic ileo-colitis?—Diarrhœa.

What are some of the causes of ileo-colitis?—Cold and damp air, or an epidemic condition of the atmosphere; and from eating crude articles; and sometimes it is caused by a want of food.

What is the treatment in the acute variety?—In mild cases a few leeches to the abdomen, fomentations, mucilaginous drinks, and a little Dov. pulv. and hyd. c. creta; but in more severe forms a general bleeding, leeching the anus, and a cautious use of astringents, the warm bath, and a bland, farinaceous diet; and should the diarrhœa continue when the inflammation has subsided, make use of the chalk julep, &c.

What is necessary in the chronic form?—Frequent local depletion, counter-irritation, and a mild mercurial course.

What medicines are beneficial in chronic diarrhœa?—Opium, logwood, kino, tr. benz. comp., cupri sulph., plumb. acet., and zinci sulph. argent. nitratum, the oak orchard water, and Hope's camphor mixture.

What is beneficial in ulceration at the lower portion of the colon?—Argt. nit. in enemata.

Is it not sometimes necessary to sustain the strength?—Yes, by tonics; and by the use of unirritating and nutritious articles of food.

COLITIS, OR DYSENTERY.

What are the symptoms of the acute form?—Uneasiness in the abdomen, griping pain, with general tormina and tenesmus, hot and tender abdomen; the stools are fœtid and dark coloured, and contain lumps, of a pultaceous character.

What are the principal types?—The sporadic, and the malignant, occurring in epidemics.

What are some of the general symptoms in sporadic cases? — In sporadic cases we have fever and its usual accompaniments, together with griping pains, diarrhœa, &c.

How is the severity of the disease increased? — By the extent of the intestines inflamed. If the lower portion only is affected it is a disease of little danger; but if the pain is diffusive, and extending along the colon, the case is more precarious; and if we have quick pulse, thirst, anxiety, vomiting, and hiccup, and rapid failing of the vital powers, it may be looked upon as fatal.

Do the symptoms of chronic dysentery vary in any important particular from ileo-colitis?—No.

Is this disease liable to be confounded with any others?—No; but it may appear similar to diarrhœa, hemorrhage from the bowels, &c.

What is the prognosis?—When the stools, from being mucous and bloody, become bilious and feculent, and the tormina and tenesmus abates, we may argue favorably.

What are some of the fatal signs? — Tumid, tense abdomen, dry, harsh skin, livid finger-nails, body supine, and legs drawn up, eyes sunk, abdomen contracted, dejections involuntary, muttering delirium, subsultus, &c.

When do we generally find improvement? — Before the seventh day; and we find the cases more fatal as the days of amendment are lengthened.

What are some of the causes of colitis? — Depression of vital powers by fatigue, watching, care, &c., and by the action of crude articles upon the alimentary canal; exposure to cold and damp.

What is the treatment of this disease? — In the active inflammatory variety bloodletting may be used, but not to the same extent as in serous inflammations; if there is much pain, cupping, leeching, and these applied over the painful parts of the abdomen, and to the anus; and by fomentations of hops, &c., to the belly.

What are some of the internal remedies? — At first a little oil with tr. opii, or hyd. ch. mit. and opium; or the latter by enema and Dover's powders, and ipecac.

What is necessary to bear in mind in the administration of hyd. ch. mit.? — That when ptyalism is produced without the symptoms abating, we must not expect benefit from it, on account of the existing ulceration in the intestines.

What other two remedies do we have, of great value? — Ipecacuanha and plumb. acet.

Are mercurials alone of benefit in the malignant form? — No.

What do we find of service in this form? — Mist. oleag., with hyd. mass., in combination, or aromatic infusion of rhei, ipecac., and opium.

Should sinking occur, what must be done? — We must resort to stimulants, as small portions of wine, or brandy-toddy, or camphor, and plumb. acet., &c.

Does the treatment of chronic dysentery differ in any great respect from ileo-colitis? — No.

What is necessary in chronic thickening and induration of the mucous membrane? — A course of leeching, and repeated bleeding.

Upon what, however, must we rely chiefly? — Upon a rigorous attention to diet, and alteratives in minute doses.

What articles and combinations have been found beneficial? — Opium and ipecac., argt. nit., Hope's nitro-muriatic acid mixture, lemon-juice, &c.

Should we pay much attention to the diet? — Yes; it should be sparing and light, consisting of liquid and semi-liquid, farinaceous substances.

DIARRHŒA.

What characterizes this affection? — An increased number of alvine discharges.

May not this arise from various causes? — Yes.

What are some of them? — Increased peristaltic motion of the bowels, increased feculent matter from morbid bilious secretion, mucous diarrhœa, serous diarrhœa, and fibrinous secretion, and fatty diarrhœa.

What is the first dependent upon? — Upon increased irritability of the intestine, and too rapid propulsion of the secretions.

What is the cause of the second? — From a large collection of excrementitious matter, as caused by fruits and other vegetable substances.

What is the cause of the third? — Increased secretory action in the liver causes the discharges, either of a bright yellow, or a greenish colour.

What is the cause of the mucous variety? — It is irritation of the follicles by substances immediately applied, or caused by congestion of the mucous membrane, from various circumstances.

Where do we find serous diarrhœa? — It is very like the mucous, but may be seen more particularly in dropsies, or in cases of Asiatic cholera.

What is the source of the fibrinous variety? — The secretion of coagulable lymph; and of sufficient consistence to be discharged as a mould of the intestine, or in detached pieces, coming from various portions of the intestinal canal.

What is probably the cause of fatty diarrhœa? — A disease of the pancreas or liver combined, occasioned by the want of the pancreatic secretion, or a disease of the pancreas and liver, by which the fatty or oily portions of diet are not digested.

What is the treatment in the different varieties? — The first variety generally yields spontaneously, or it may be proper to administer some anodyne and antispasmodic; in the second variety. a mild laxative and

opiate are generally sufficient; and in the third, demulcents, opiates, and a slight mercurial course.

How would you treat the mucous form? — By diverting the blood from the part, allaying irritation, and diminishing morbid secretion.

What remedies are beneficial? — Counter-irritation, spts. mindererus, and for allaying internal irritation, the vegetable astringents, and anodyne injections, &c.

What is necessary in the serous variety? — Opiates, and vegetable astringents; but we may be compelled to resort to metallic salts, as acet. plumb. et. cupri sulph.

What is the management of the fibrinous variety? — A course of alteratives; and then turpentine, copaiba, benzoin; tonic medicines, as limewater, chalybeates, and nitric acid in bitter infusion, and the use of the warm bath, &c.

How should the diet be regulated? — The food should be mild, farinaceous, but nutritious.

What is necessary in the fatty diarrhœa? — Avoid all fatty or oily articles of diet, and correct, if possible, the secretions of the liver and pancreas by alkalies, a slight mercurial course, and counter-irritation over the parts nearest to the organs affected.

CHOLERA MORBUS, AND ASIATIC, OR CHOLERA ASPHYXIA.

How is this affection divided? — Into common or sporadic, and the epidemic, malignant, or Asiatic cholera.

What are the symptoms of the sporadic variety?—Frequent vomiting and purging, first of the contents of the stomach, and then a liquid follows tinged with bile, and excessive in quantity; pain in the abdomen and limbs; the pulse becomes small and frequent, voice weak, the countenance is haggard, and great thirst is present, and the body covered with clammy perspiration.

What are favourable indications?—Cessation of the discharges and cramps, and general amelioration of the preceding symptoms.

How long does the affection last? — From three to four days, or more frequently for a shorter time.

Is the convalescence rapid? — Yes; though some signs of gastric irritability may exist for some time.

What are some of the causes? — The season of the year, unwholesome food, drastic purgatives, cold drinks when the body is heated, or by a sudden transition of temperature.

What is the treatment?—Opium, in large quantities, and repeated, or with calomel, diluent drinks, frictions by means of stimulating articles to keep up warmth; and if collapse takes place, we resort to brandy, camphor, ammonia, blisters to stimulate, &c.

How should we treat the debility? — By mild stimulants, nutritious diet, &c.

MALIGNANT, OR ASIATIC CHOLERA.

Where did this affection first show itself? — In the East Indies.

Where has it extended? — Over nearly the whole world.

Is the contagiousness of this affection settled? — No; there is still great difference of opinion on this point.

What are the symptoms of malignant cholera?—They almost always show themselves suddenly, but sometimes we have a feeling of uneasiness preceding them, with diarrhœa, watery or serous purging, and followed by vomiting, and cramps. After the contents of the stomach are discharged, we have whitish, turbid fluid, like rice-water; this has a slight sickly smell, and passes without straining, and is often in large quantities.

Where do we have cramps? — In the belly, and in the muscles generally, contracting them into hard knots; then we have slight relaxation, and then cramp again.

What other symptoms are there? — Headache, and noise in the head; very soon a pulse scarcely felt; the surface cold; the blood appears in a completely congested state; the conjunctiva becomes dry; the tongue is pallid, or slightly blue, cold, and covered with thin mucus; the palms of the hands and soles of the feet are shrunk and sodden; the pulse is feeble and fluttering; burning at the præcordia; thirst, &c.

Is there much oppression in the breathing? — Yes.

How is the intellect? — Unaffected, generally.

What happens after a few hours? — The violent symptoms subside, the discharges and cramps cease, but the usual warmth of surface and the pulse do not return, or only transiently, and the patient relapses, and becomes covered with a cold, clammy sweat, and dies within seven, eight, or twelve hours.

If the case is not a fatal one, what occurs? — After the symptoms, being more or less violent, they gradually subside, and we have heat of surface returning, discharges ceasing, anxiety and oppression diminishing, pulse regains its power, and reaction becomes fully established.

What is the usual course after the attack? — The patient either convalesces immediately, or recovery is slightly retarded by the supervention of internal inflammation of a mild character; or we may have a secondary fever of a typhoid character, and from which the patient is not likely to recover soon.

What is the prognosis in this form of cholera? — Unfavorable.

What are some of the circumstances which make it unfavourable? — The severity of the early symptoms, with a combination of general unfavourable signs.

What are the peculiar anatomical characters? — These are so various and so uncertain, that we are unable to introduce them here, but must refer to works on pathological anatomy.

What is the treatment?—It has been various, and as yet no settled plan has been adopted; some of the remedies which have attracted attention, we will ennumerate.

What are they? — Heat and friction by means of bags of hot bran, and by friction with a coarse brush; venesection in the onset of the disease has been used with decided advantage; opium alone, and in combination; calomel in large and frequent doses, warm drinks of cayenne pepper tea, or the other stimulants.

By whom was large doses of saline articles recommended? — By Dr. Stevens.

Who adopted the plan of injecting a solution of salt into the veins? — Dr. O'Shaughnessy.

What effect seemed produced by this plan?—The patient appeared to improve for a short time, but gradually relapsed.

Upon what theory was this plan based? — The want of saline matters in the blood.

Has acetate of lead been used with benefit? — Yes.

Has not chloroform internally administered, either alone or in combination with morphia, been found a valuable remedy to arrest vomiting, and to relieve pain? — Yes.

Will not chloroform, in some cases, relieve the violent spasms of the muscles of the extremities when rubbed upon the parts? — Yes.

When the period of reaction has arrived, what is necessary? — We must endeavour to repair the loss of serum the blood has sustained.

Which way can we best answer this end? — By the administration of saline fluids, animal broths, &c.

Should any inflammatory affection of the chest supervene, what must be done? — We must resort to local depletion, and the administration of saline articles.

COLIC.

What do you mean by colic? — A disease of some portion of the gastro-intestinal canal, with morbid sensibility and contractility, with morbid secretion, commonly of air, manifested by acute pain, producing a feeling of rolling and twisting alternately, with flatulent distension, and almost always with constipation.

How many varieties do we embrace under this head? — Simple colic, including nervous, flatulent, and stercoraceous, bilious colic; dry belly-ache, or colica pictonum; ileus, &c.

What have these varieties in common, and by what caused? — Exaltation of intestinal sensibility, with unequal contraction and dilatation of portions of the intestinal tube; pent up flatus, constipation, and sometimes inflammation; and these are caused by indigestible matters, sudden chill, suppression of perspiration, &c.

What is the chief cause? — Morbid excitement of the nervous

system by gross irritation, or by derangement of the secretions of the part, with generally an absence of inflammation.

What is the character of the pulse? — Little, if at all, changed.

What individuals are more liable to this disorder? — Females, and persons of sedentary habits, and individuals generally of nervous and irritable temperaments.

What is the treatment of the simple variety? — In slight cases a little aromatic water, or the essential oils will be beneficial; but if the case continues, we must resort to opiates and antispasmodics by the mouth and by injection, application of warmth externally, &c.

When it arises from indigestible food, what is necessary? — An emetic, followed by a mild laxative.

STERCORACEOUS COLIC.

What do you mean by stercoraceous colic? — That arising from an accumulation of fæces in the large intestine, or of intestinal concretions.

Are not lumps sometimes felt in the intestine when it arises from this source? — Yes.

What are the symptoms more peculiar to this form? — The pain is more particularly referred to the colon, and between the iliac region and umbilicus, and is more fixed; pain is felt in the kidneys, the urine is scanty, high-coloured and offensive; the stomach is irritable; the pulse slow, full, and hard, and the tongue white and moist.

What is the treatment?—The procuring of an ample evacuation by means of cathartics and enemata, and the prevention of a return of the affection by the general improvement of the tone of the intestines.

What are some of the remedies that have been used? — The usual cathartics and antispasmodics, the introduction of the tube per anum. Tobacco enemata have been used; and (if we should have inflammation), bleeding locally and generally; the ol. tiglii, &c.

BILIOUS COLIC.

When does this affection principally occur, and by what is it caused? — Chiefly in the heat of summer, and is generally caused by over loading the stomach, the use of spirituous and acescent liquors, and exposure to the intense heat of the sun, &c.

What are the symptoms? — It is sometimes preceded by indigestion and slight fever, and frequently its attacks are sudden and with only a slight chill, after either of these causes; and we have irritability of stomach, vomiting of bilious matter, pain, and flatus in the intestinal canal, cramps, coldness of surface, followed by flushed countenance, beating of the temporal arteries, and the pulse is frequent, hard, and voluminous; the tongue is loaded and yellow; the countenance has now become anxious and dingy, and we have present, constipation of the bowels, &c.

What do we find by post-mortem examination ?—Inflammation and congestion of various portions of the intestinal canal, morbid accumulation of blood in the liver, &c.

What is the treatment ? — Venesection, emetics, the administration of opiates, fomentations, and sinapisms to various parts of the body: and then the administration of enemata of a stimulating character, until the bowels are freely evacuated.

Should pain recur, what is necessary? — Warm opiate enemata should be administered, and then administer calomel in large doses, to produce an effect upon the liver, and to evacuate the bowels.

Should the physician leave the patient at this time? — No; he should be on the alert, and watch for any untoward symptoms, so as to prevent a relapse.

What should be the diet ? — That of the mildest character; and the bowels should be opened, if necessary, by mild enemata.

What is beneficial to quiet the irritability of the stomach ? — By rest from all stimuli, and by bland diluents; by revulsion by leeches, and stimulating liniments and frictions over the abdomen, and opiates.

How would you prevent a relapse? — By proper attention to the secretions and excretions, and avoiding anything like exposure.

LEAD COLIC.

What other names has this affection ? — Dry bellyache, colica pictonum, painter's colic, and Devonshire colic, &c.

What is generally said to be the cause of this form ? — The poisonous action of lead upon the system.

Who are most liable to this form ? — Plumbers, lead miners, manufacturers of white lead, and workers in lead generally.

What other causes have we ? — Drinking from vessels which have a preparation of lead in glazing, and from drinking water kept in leaden vessels.

Does the history of the patient afford any ground for judgment? — Yes.

What are the symptoms ?—It has many symptoms in common with the other forms of colic, but the particular ones are the increase in the pain from dull to sharp, and extending from the hypochondria to the back, with pain in the limbs; spasm of the respiratory muscles; the tongue is flat and tremulous, and the countenance dingy in hue, and dejected, and the stools hard, dry, and knotty.

Is this affection often fatal ? — No.

What are some of the sequences ? — Partial palsy, impaired digestion, and debility of the whole system.

Are we well acquainted with the anatomical characteristics of this affection ? — No; but it is probably of a neurotic character.

What is the treatment ? — Similar, in many respects, to the foregoing. Sulph. alum et. potas. has been used, and opiates; while mercury, pressed to ptyalism, is of decided advantage.

What is sometimes used by workmen to prevent an attack?—A dose of castor-oil daily.

ILEUS.

What is ileus?—It is a species of colic, either with impaction in the bowels, or an intussusception or invagination of the intestines.

What are the symptoms?—Pain of a twisting character around the umbilicus; obstinate costiveness, and vomiting without fever; by and by, if there is no relief, the abdomen is tender, tense, and tympanitic; vomiting is often stercoraceous, with severe tormina, and rapid failing of strength.

What are the causes of this affection?—Most generally the same as those of colic, conjoined with some mechanical obstruction.

What are the anatomical characters?—These are various; and while in some cases we find obstruction of the bowels, in others we have gangrene, and in others, again, spasmodic constriction, and in some we find nothing.

Is intussusception frequently met with?—No.

Which parts of the intestine are most liable to this?—The ileum and jejunum.

What is the situation of the tissues in intussusception?—Two mucous and two serous surfaces are in contact.

What are some of the causes of this affection?—Worms; inflammation as a consequence of dysentery and chronic diarrhœa; drastic purgatives, &c.

What is the termination of intussusception?—By restoration of the intestine; and by death, either with or without inflammation.

Which is the most dangerous form of intussusception?—Where the invagination is from above downwards.

How is the form of intussusception from below upwards relieved?—After adhesions have formed between the two opposing peritoneal surfaces, the ends of the intestine slough off and pass out by stool.

How would you form a diagnosis of intussusception?—This is difficult, and we must depend principally upon the tact of the practitioner in examining the abdomen; and from the vomiting sometimes of stercoraceous matter, &c.; and also by the irregular pulse, and the suddenness of the attack.

What is the treatment?—After examining the abdomen carefully to find out the cause if possible, attending to the points of pain, we must resort to the usual remedies in colic, viz.: bloodletting, purgatives, enemata, &c.

What is necessary in addition to this?—The administration of tr opii, by enema; the belladonna ungt. externally; warm bath, &c.

Knowing the tendency to inflammation, should we early resort to the lancet?—Yes.

What other remedies must we resort to?—Local depletion; blister over the point affected; ol. terebin., fomentations, &c.

Is purging of much benefit?—No; but if there is much irritability of the stomach, calomel in small quantities must be used, either alone, or in combination with opium and camphor.

What enemata have been used?—Turpentine, assafœtida, &c.

Is not tobacco enemata beneficial?—Yes; but it must be used with great caution.

What other remedies have been resorted to?—Ingestion of crude mercury, of warm water, warm oil, and, finally, a surgical operation.

TORPOR OF THE COLON.

What is the cause of this?—Deficient contractile power in the intestine, by which fæcal matter is detained and accumulated in the bowels; this is one of the most common causes of constipation.

From what may this arise?—It may arise from a general asthenic condition of the system; from over-feeding and little exercise; want of compression of the abdominal muscles; indigestible food; want of nervous energy.

Does spinal irritation ever produce this affection?—Yes.

What are the signs of torpor of the colon?—Constipation, tympanitis, borborygmi, depraved or lost appetite, bad digestion, the tongue is pale, sodden, puffed; breath fetid, countenance anxious, pains in the head and loins, palpitation, dyspnœa, &c.

What are some of the bad effects of this?—We have disorder of the stomach and bowels, obstruction of the biliary duct, jaundice, &c.

What is the treatment?—To unload the bowels by cathartics and enemata.

What purgatives are beneficial?—Dec. aloæ. comp., inf. senna., tr. jalap., pil. gambog. comp., &c.

What next is necessary?—To remove the tendency by proper hygienic and dietetic management.

How would you restore the tone of the colon?—By tonics and laxatives, as pil. of aloe et myrrh. cum quinia, or ferri sulph., frictions to the abdomen, tepid or cold affusion; and if there is spinal irritation, by applications to the spine.

Should not dietetic regimen in all cases be preferred to medical?—Yes; the laxative articles of diet should be preferred.

TYMPANITES.

What is meant by this term?—Distension of the abdominal parietes by a large collection of gas in the intestines.

Is this affection common?—Yes.

When do the acute and chronic forms generally happen?—The acute may happen as an attendant upon peritonitis, colic, typhoid fever, &c.; and the chronic form, though sometimes attendant upon other affections, may exist entirely alone.

What are the diagnostic marks of tympanites?—Clear resonance

on percussion, and by equable distension of the parietes of the abdomen, &c.

What is the pathology of this? — This varies with the disease it accompanies; and in the chronic variety it is caused by want of tone in the muscular fibre of the intestines.

By what is the gas formed? — By imperfect digestion of vegetable substances, and may also be induced by direct secretion.

What is the treatment? — We may resort to leeching, blistering and frictions externally, and by the administration of ol. terebinth. in various forms; by carminatives, and by aperients and antispasmodics; and for a more permanent cure, upon a combination of aperients and tonics.

What are some of the special remedies? — Strychnia, cold water by affusion, elastic belt, and by the removal of the air by passing up a tube, &c.

PERITONITIS.

What is peritonitis? — Inflammation of the peritoneum, or lining membrane of the abdominal parietes, and of this membrane reflected over the contents of the abdomen.

What are some of the symptoms? — A feeling of lassitude, chills, pain in the limbs, acute pain in some part of the abdomen; and this pain is aggravated by any movement of the body, which puts the abdominal muscles in action.

Is pressure borne easily? — No; pressure is extremely painful; and on this account the patient lies with his knees drawn up, to relax the abdominal muscles.

What are the general symptoms of peritonitis? — The surface of the abdomen is dry, hot, and tense. The bowels, if not at first constipated, soon become so; the pulse is rapid, small, and hard; and the countenance is distressed and anxious.

May not peritonitis sometimes exist without our being aware of it, from any peculiar symptoms? — Yes.

What is considered as one of the best signs of inflammation? — Tenderness of the abdomen.

May not the effusion of coagulable lymph be sometimes discovered by the ear or hand? — Yes.

What has this affection been confounded with? — Enteritis, ileus, hysteria, &c.

How would you distinguish between them? — In the first, we have diarrhœa and deep-seated pain, and a milder pain and less tenderness, by the softer pulse, &c.; and in the second, we have the inflammatory symptoms coming on after an obstruction; and in the third, by the history of the case; the tenderness being superficial, and upon deep pressure being made, the pain is relieved; and by the tenderness being more diffused over the body; and also by pressure upon the lumber vertebræ eliciting pain.

What are some of the causes of this affection? — Those of the usual phlegmasiæ; also from mechanical injuries; also by parturition, or the introduction of any foreign substance into the abdominal cavity; and also it may be produced by metastasis from rheumatism, and by a peculiar contagion.

What are the anatomical characters ?—Redness, effusion of lymph, adhesion : sometimes serum and pus in proportion to the stages of inflammation; in some cases the inflammation may be partial. Gangrene and ulceration are quite rare.

What is the prognosis ? — If the case is seen early in the disease, we may anticipate a favourable issue, but if allowed to run on, it is almost hopeless.

What are some of the most unfavourable signs? — Tympanites, with obstinate constipation and vomiting; the pulse frequent and thready, and the strength prostrate, with hiccup and cold perspiration.

What is the general duration of fatal cases? — These are various; they may run their course in less than thirty-six hours, or they may last for a fortnight, or three weeks, but they most generally last from six to eight days.

What is the treatment? — To overcome the inflammation by every possible means, as bloodletting pushed very far, and this repeated if necessary; and by leeching frequently.

When are blisters beneficial? — In the advanced stage, when the abdomen is tumid and tympanitic, and the first signs of inflammation have disappeared, and after bleeding has been freely resorted to.

What are some of the best external applications? — When inflammation is active, warm poultices, hot turpentine fomentations, and sometimes cold evaporating lotions.

What purgatives should be used? — The mildest laxatives.

Is not mercury beneficial? — Yes; and should be used, from the onset of the disease, in alterative doses.

How would you allay the vomiting in the case? — By means of hot laudanum fomentations, sinapisms, creasote, hydrocyanic acid, limewater and milk, ice, &c.

When all hopes by medical means have failed, what must be done? — Support the strength of the patient, and favour a spontaneous cure.

What is that form of peritonitis called, under which lying-in women sometimes labour? — Puerperal.

What are some of the symptoms of peritonitis from intestinal perforation? — Great pain, coming on suddenly, followed by great frequency of pulse, collapse of features, and general prostration.

What is the end of this form? — Nearly always fatal.

Must we leave our patient to his fate in these cases? — No; we must support the strength, and administer opium freely, and sometimes turpentine

CHRONIC PERITONITIS.

What are the symptoms of this form? — Very little, and sometimes no pain; a burning heat may exist near the stomach, the bowels are irregular, and the evacuations either of a light yellow or stone colour, and very fœtid; there is much nausea, and the tongue is generally of a bright red colour, and of uneven surface, and the substances vomited are green and thick; there is much emaciation, and the whole external physiognomy is changed; the abdomen is protuberant, and, if fluid is present, we will find fluctuation; and we have also a doughy feel over the surface of the abdomen.

What are the causes of this form? — The acute variety may pass into this form, or it may arise also from a tuberculous diathesis.

Who are more liable to this form?—Females between fourteen and twenty-one.

What is the prognosis? — Generally unfavourable.

What are some of the anatomical characters? — The peritoneum in its various inflexions is found agglutinated together; we have also sanious serum and pus; tubercles may be found; thickening of the peritoneum; enlargement of mesenteric glands, &c.

What is the treatment? — Sometimes topical bleeding, repeated blistering, frictions with liniments and ointments; iodine and opium to relieve pain; and the vegetable alteratives in combination with vegetable tonics.

What should be the diet? — Nutritious and various.

DISEASES OF THE BILIARY ORGANS.

What are some of the causes of disorder in the biliary organs? — Atmospheric heat; a large quantity of highly-seasoned animal food; a sedentary life; external injury; alcoholic liquors, the incautious use of mercury. In cases of injury of the head we frequently have abcess; mental emotions often favour it, and it also follows other diseases, viz.: the different forms of fever, dysentery, and diseases of the heart.

What are some of the functional derangements? — A diminished and vitiated secretion of bile, and impeded excretion of it.

Is the term bilious, as used commonly, at all significant? — No.

What is considered a sign of diminished biliary secretion? — The paleness or dull ash-colour of the fæces, where there is no evidence of mechanical obstruction in the ducts, and a highly brown colour of the urine.

What is considered as the sign of excessive biliary secretion? — The yellow or green appearance of the alvine discharges; but this is doubtful.

What are the causes of excessive biliary secretion? — Elevated temperature; the plentiful use of animal food; and when we have jaundice, without deficiency of bile in the stools, we may look for an excess of biliary matter in the system.

What are some other causes?—An altered hepatic circulation; also particular states of the nervous system; and a deranged action of the intestinal canal.

Can we give any particular reason for the vitiated secretion of bile? — None, except the general one, of vitiated blood.

From what causes may the excretion of bile be impeded?—By mechanical impediments and spasm of the ducts, and from viscidity of the bile.

What are some of the signs of functional derangements? — The appearance of the evacuations being either yellow or otherwise; also from their green colour; and also from a white appearance sometimes existing in them.

What is the treatment of the functional derangements? — In excessive secretion we avoid exposure to high temperature; diminish animal food; to increase biliary secretion, we use cholagogues, as mercury; regulate the diet, and administer laxatives, &c.

Is it at all known how we may change the biliary secretion when vitiated? — No.

How would you favour the excretion of bile? — Emetics may be beneficial, so also laxatives, &c.

What is the general character of gall-stones? — The composition is various; they may consist either of the yellow matter of the bile, of the resinous matter of picromel, and of cholesterine.

What are the symptoms of biliary calculi? — When they form an obstruction in the ducts, we have jaundice, whiteness of stools, and muddy redness of the urine, and there is frequently great pain, especially during the passage of a calculus along the ducts.

Where is this pain situated? — In the pit of the stomach, extending to the right hypochondrium and back, and recurring in paroxysms.

What is the treatment of biliary calculi? — We must obviate the cause of their formation; and during an attack we must facilitate the passage of the gall-stones by the administration of opium, warm baths, fomentations, emetics, bloodletting, &c.

What are some of the affections to which the gall-ducts and biliary passages are liable? — In addition to what have been mentioned, we have enlargement of certain glands in the capsule of Glisson; thickening from inflammation of the mucous membrane of the gall-bladder and ducts; also by purulent effusion, contraction of the parietes of the gall-bladder and ducts, and obstructions in the ducts.

What is the treatment in these forms of disease? — That of the affections of the liver generally.

HEPATITIS, &C.

What parts of the substance of the liver are liable to inflammation? — The parenchyma, and its investing serous covering.

What are the varieties? — Acute and chronic.

Upon what may congestion depend? — Upon obstruction of the circulatory system of the liver; or it may be produced by increased vascular action, &c.

What is the character of the liver in this state? — It may be either red or mottled; or we may have extravasation of blood, either escaping in the intestines or in the cavity of the abdomen.

Does hepatic hemorrhage depend upon other causes than congestion? — Yes; from rupture or ulceration of the larger vessels.

What is that peculiar appearance we find in pernicious intermittents? — We have black blood coagulated, similar to the spleen.

What are the symptoms of congestion? — We have weight and fulness of the liver, and it projects beneath the ribs, &c.

What is the treatment? — Upon the principles of chronic inflammation.

ACUTE HEPATITIS.

What are the premonitory and general symptoms of this affection? — They are similar to those of ordinary fever, but soon after we have some local signs, which show the character of the affection; the skin is hot and dry; the pulse full and hard; tongue covered with a yellow fur; with thirst and bitter taste in the mouth; nausea and vomiting, of a bilious or dark-coloured fluid; bowels constipated; urine scanty and high-coloured, and depositing a lateritious sediment.

What is the general type of the fever? — Inflammatory; but it may become typhoid.

What are some of the local symptoms? — Pain in the region of the liver and epigastrium, increased by pressure or by inspiration and cough, or by lying on the right side; and the pain is greater when the peritoneal coat of the liver, or that part of the parenchyma nearest to the surface, is affected.

Do we not also have pain shooting up to the right shoulder?—Yes, generally.

Do not other parts of the body frequently sympathize? — Yes.

Is not the function of respiration frequently affected? — Yes.

What other local sign have we? — Tumefaction, detected by percussion.

What are the terminations of this disease? — Resolution; effusion of serum in the substance of the liver; the effusion of coagulable lymph; formation of pus, and consequently of abscess, and this discharging into the cavity of the abdomen; or else by pointing outwardly, or in the intestinal canal, or in the kidney, or the vena cava.

Do we ever have gangrene? — This is still doubted.

CHRONIC HEPATITIS.

Are the symptoms of chronic hepatitis very marked?—No; we may have all the signs of dyspepsia in its various forms, &c.; and, with the exception of pain on pressure, find the liver apparently healthy.

Do post-mortem examinations develop anything marked?—Not generally.

What may distinguish gastro-enterite from hepatitis?—The characters of the fever in the first, it being generally typhoid; and in the latter, acute and inflammatory.

How would you diagnosticate it from chronic pleurisy with effusion?—In chronic pleurisy we have obliteration of the intercostal spaces, while in this we have more marked spaces than in the natural state.

What is the treatment of hepatitis?—Venesection, regulated by circumstances, followed by local depletion, and especially leeches, warm poultices to the part, and purgatives.

What purgatives are the most proper?—The mercurials, neutral salts, and the cholagogues generally, &c.

Are counter-irritants and blisters of benefit?—Yes, in the advanced stages of the acute variety, and also in the chronic forms; and we may also sometimes use setons and issues.

Is it of the greatest importance to attend to the diet of the patient?—Yes.

Must the physician lose sight of the disease if there should be a temporary amendment?—No; for the disease may be deeply seated, and abscesses may form, &c.

When is it considered as the most auspicious moment for administering mercurials?—After the violence of the attack has been in a great measure subdued by the ordinary antiphlogistics.

Is the mode of administration of the mercurials in regard to quantity or time well settled?—No; but the weight of evidence seems to be in favour of small doses, frequently repeated.

What other article has been used with decided advantage in hepatic affections?—The nitro-muriatic acid, both internally and externally.

Has taraxacum any reputation in these affections?—Yes.

Should hepatic abscess exist, pointing externally, what points would favour your undertaking the opening of the abscess?—From its being in the investing membrane of the liver, without involving the parenchyma; the smallness of the abscess, the existence of adhesions to the surrounding parts, the prominent signs of pointing, the age and constitution of the patient, &c.

HYPERTROPHY, ATROPHY, INDURATION AND SOFTENING.

What is meant by hypertrophy of the liver?—An increased growth of the structure of the liver, independent of inflammatory action. It is a rare affection, and not easily diagnosticated.

What is meant by atrophy of this organ?—The reverse of the preceding, where there is simultaneously a diminution of bulk and weight. Its diagnosis is difficult.

What is induration of the liver?—In some cases, we have increased density and hardness from foreign depositions in its substance; in others, the parenchyma is indurated without such causes. These may be present with increased or diminished bulk.

What is the cause of softening of the liver?—It is a frequent result of inflammatory affections, and presents various stages of softening, and various appearances at different times, upon post-mortem examination.

CIRRHOSIS, OR GRANULAR DEGENERATION.

What is meant by this?—The development on the surface and in the substance of the liver of innumerable corpuscles, or granules of various sizes, with a diminished bulk of the organ, together with increased hardness, denseness, and roughness upon the surface. The colour of the corpuscles are of various tints, from a canary to a brown or yellowish red hue; when cut into, tense granules are distinctly seen upon close examination.

What is the nature of this disease?—Various opinions have been expressed. The most probable is the increase in bulk of the acini, by the deposition of the peculiar yellow matter, and the irritation it may induce.

Are the symptoms and causes of cirrhosis well marked?—No; it may be inferred from general derangement of the hepatic function, accompanied with ascites, a diminished size of the liver, &c.

Is there any peculiar treatment in this affection?—No.

FATTY DEGENERATION.

What are the marks of this form of degeneration?—We have usually an enlargement of the liver. It has a yellowish or cream colour, with brownish, deep orange, or red spots upon it. It is generally softer than natural; it has an unctuous feel; and greases the knife, or paper.

What is the nature of this change?—Its size is probably dependent upon increased oily deposits in the oil cells, with greater or less atrophy of the surrounding parenchyma.

What is this affection an attendant upon?—Phthisis pulmonalis.

What are some of the other structural diseases of the liver?—Serous cysts and hydatids, tubercles, malignant tumours, &c.

JAUNDICE.

What is jaundice?—It is a symptom of diseases occurring under different pathological states, either with or without inflammation in

the biliary organs, and where the fluids and solids of the body are tinged more or less deeply with bile.

What are some of the causes of jaundice?—Mechanical obstruction to the exit of the biliary secretion, and consequently the bile is reabsorbed in the system; or the innervation of the liver is injured, and is unable to perform its ordinary function; and the materials of bile are not separated from the blood.

What other causes have we? — Spasmodic jaundice occurring in hysterical or hypochondrical patients; but where the exact seat of spasm is, we are unable to tell.

Do acute and chronic diseases of the liver favour jaundice? — Yes.

What is the most important and frequent cause of jaundice?—Disease of the mucous membrane of the stomach and duodenum.

How would you explain the action of the irritation in the mucous membrane of the stomach or duodenum, producing jaundice? — By sympathy.

What fever does pathologists now think depends upon gastro-intestinal irritation, with the liver sympathizing?—The yellow fever; and consequently we have jaundice in its course.

Does the sympathetic action of the brain upon the liver ever cause jaundice? — Yes.

What solid and fluid of the body is an exception to the law of universal colouring by jaundice? — The substance of the brain, and the milk during lactation; and possibly the humours of the eye.

Do we ever have jaundice in young children? — Yes, shortly after birth, depending upon irritation in the intestinal canal.

Do we not often find jaundice existing in patients without their feeling any bad effects from it? — Yes.

Who are those most liable to jaundice from gastro-duodenal irritation? — Dyspeptics, and individuals subject to diarrhœa; but it may occur in individuals, who, after exposure to intense heat, use some articles irritating to the gastro-enteric mucous membranes.

What two forms does jaundice take in this country? — Either the mild, passing off spontaneously, or the severe and fatal, &c.

What are some of the symptoms of the severe form?—After using some irritating article of diet, from which the patient is indisposed for several days, we have nausea, vomiting, thirst, anorexia, burning in the epigastrium, and tenderness in the stomach and duodenum, with a foul tongue, the bowels are costive and clay-coloured, and the urine is high-coloured and loaded.

What is the general condition of the patient? — There is great prostration of strength, with vertigo, low spirits, &c.; and there is fever, sometimes passing off in a day or two, or lasting for some time, and tending to produce the most dire results.

Is the variation in the intensity of the colouring of the skin favourable or unfavourable? — Unfavourable.

Is coma a highly unfavourable sign? — Yes.

Is the diagnosis of jaundice arising from gastro-duodenitis or from hepatitis, difficult?—No; not when we bear in mind the peculiar symptoms.

What is the treatment of this form of the affection?—We have little or no fever, and the jaundice often disappears without any treatment, relying upon a regulation of diet and laxatives, and prohibiting anything stimulating; but, in more severe cases, we must use topical depletion, iced drinks, &c., and remove inflammation with laxatives and enemata.

Are mercury and alkalies beneficial in this disease?—Yes.

Should coma supervene, what is the most approved treatment?—The head should be shaved, and ice applied, with leeching behind the ears, blisters to the nape of the neck, and purgatives.

Does there not exist a strong analogy between the severer forms of jaundice and yellow fever?—Yes.

In the form of jaundice depending upon biliary calculi, what are the symptoms?—Sudden pain in the epigastrium and right hypochondrium, the stomach is nauseated, and cardialgia and vomiting is present, and the pain is referred to the region of the gall-bladder; the abdominal muscles are spasmodically contracted, and we have convulsions, fainting, cold extremities and perspiration, and the pulse is hard and contracted, with no fever, and this is somewhat pathognomonic; and sometimes we have a tumour in the right hypochondrium.

Does not the patient enjoy times of perfect ease in the interval between the paroxysms?—Yes, frequently.

What is the treatment in a case arising from biliary calculi?—To guard against inflammation, to allay spasmodic pain, and to favour the passage of the stone.

How would you answer these indications?—By venesection, topical depletion over the region of the gall-bladder, brisk purgation by cathartics and enemata, and the administration of opium in full doses.

Have tobacco injections ever been used?—Yes; and they are of decided benefit.

What is the objection to the employment of emetics?—Rupture of the gall-bladder.

What other external remedies have been found highly beneficial?—Warm baths, fomentations, &c.

In spasmodic jaundice, what is to be done?—It must be treated in the usual manner, as if nervous excitement existed, by purgatives and antispasmodics.

Is the precise mode of action in the cases of brain affections occurring in jaundice known?—No; not unless we consider the nutrition of the brain injured from the morbid state of the blood.

DISEASES OF THE PANCREAS.

What are the principal diseases attacking the pancreas?—We may have a disorder of the secretion, both in regard to quantity and qua-

lity. The pyrosis which attacks some is thought by many to arise from a diseased state of the pancreas. We may also have congestion and hemorrhage; inflammation, both acute and chronic; and these may terminate in the usual manner of inflammations — hypertrophy, atrophy, induration, cartilaginous transformation, fatty transformation, steatomatous concretions, cancerous and scirrhous degeneration, melanosis, calculi, &c.

Is the diagnosis of this affection at all certain? — No; unless we consider fatty diarrhœa one, arising from causes before mentioned, when treating of that form of diarrhœa.

Are the symptoms at all peculiar? — No; and consequently the treatment is entirely in the dark.

DISEASES OF THE SPLEEN.

Are we acquainted with the functional diseases of this organ? — No.

To what, then, must we direct our attention? — To the organic affections, viz.: inflammation, congestion, hypertrophy, softening, rupture, induration, purulent formations, tubercle, atrophy, &c.

What are the signs of disease of this organ? — Enlargement, extending to the left hypochondrium, to the epigastrium, or to the umbilicus, &c.; and this enlargement may be felt by external pressure; there may be also dulness upon percussion.

May not other tumours be mistaken for diseased spleen? — Yes; and they may occur either in the acute or chronic variety.

What other symptoms do we have of splenic affection? — Pain, oppressed respiration, cough, with or without expectoration, bending of the body to the affected side, placing the hands in the region of the spleen, inability to lie on the right side, depression of spirits, dingy yellow colour of the skin, tendency to dropsy, and dysentery, &c.

What are some of the causes? — Certain articles of diet, and a blow in the region of this organ, especially in those parts of the country where we have a tendency to spontaneous development of this form of disease.

In what fever do we find enlargement of the spleen most general? —In intermittent fever.

Do we not frequently find disease of the spleen and of the heart co-existing? — Yes.

Affections of what other organs of the body have we as frequent complications?—Those of the stomach and liver.

Do we not frequently find enlargement of the spleen occurring in deranged menstrual function? — Yes.

Do not metastatic inflammations frequently occur to this organ? — Yes, particularly gout.

What districts particularly favour enlargement of this organ?—The damp and marshy, &c.

How is the treatment of diseases of the spleen divided?—Into that for the acute and chronic varieties.

What is the treatment in the acute form?—That of the usual inflammatory affections.

What is proper in the chronic form?—That of the usual chronic inflammatory affections, viz.: blisters, &c.

Is purging proper in the chronic form?—By some purging is highly recommended, while others disapprove of it.

Is mercury of service in diseases of the spleen?—No, not generally.

What remedies have been highly extolled?—Cinchona and its preparations; also iodine externally and internally.

Where has the actual cautery been used externally?—In the East Indies.

Is not compression of service in this affection?—Yes.

Are not hygienic means of service in splenic affections?—Yes.

DISEASES OF THE URINARY ORGANS.

In diseases of the urinary organs, what first necessarily attracts our attention?—The correct knowledge of healthy urine.

What is the quantity of urine passed by an individual under the most favourable state of health and correct diet?—The average quantity is daily, 35 ounces; and its density is about 1.015 for adults; 1.012 for children.

What is the colour, taste, &c., of healthy urine?—A lively wine, yellow, transparent, limpid colour, aromatic odour, and of an intense bitter saline taste, slightly acid; alkaline and ammoniacal when long kept.

What is its general composition?—Water, urea, lithic acid, with ammonia, carb. acid, alkalies, sulphates, phosphates, hydrochlorates, lactates, phosphates of lime and magnesia, colouring matter, silica, and fluoride of calcium, with some mucus, &c. Some of these compounds are merely accidental.

What are some of the circumstances which favour a variety in the character of urine?—Diet and drink, heat or cold, character of occupation, age, sex, and time of day when voided.

What influence has vegetable or animal diet upon the character of urine?—Vegetable diet diminishes, and an animal diet increases the proportion of urea and lithic acid; and particular articles of diet produce greater or less results in the degree.

Which articles favour most the formation of lithic acid?—Cheese and pastry.

To what forms of disease are the kidneys liable?—To functional and organic.

What are some of the functional diseases?—Gravel calculus, diabetes, hematuria, suppression of urine, &c.

What are the organic diseases?—Granular disease, or that of

Bright, nephritis, tubercles, urinary and serous cysts, malignant diseases, &c.

What are some of the morbid states in regard to function ?—Sometimes we have the urine increased, or sometimes reduced in quantity; the density may be either too high or too low; the solids in its constitution may be increased, and its sensible quantities may be affected.

Which are some of the ordinary ingredients that may be affected ?—Urea; this may be either too much or too little; lithic acid, partaking of the same variations. The earthy phosphates may exist in either too large or too small quantities; and we have the same variety in regard to mucus in the urine, and also the muriatic and phosphoric acids.

What other substances may we find, sometimes, which should never exist? — Blood, albumen, sugar, milk, an oleo-albuminous matter, pus, spermatic fluid, carbonate of lime, nitric acid, oxalate of lime, &c.

What are some of the sediments to be found? — A black sediment, red and purplish sediment, cystine, prostatic calculi, &c.

Do not some articles of food and drink impart peculiar odour, colour, &c., to the urine? — Yes; viz., asparagus, horseradish, beetroot, &c.

What are some of the causes for the great variety of substances of an organic nature to be found in the urine? — By the mutual action and reaction of elementary substances upon each other.

From what do various morbid affections of the urine arise? — Either from the primary morbid condition of the kidney, or from a secondary cause, by which the kidneys are implicated.

What classes of affections of the kidneys shall we notice? — Those which are either connected with primary functional disturbance in the kidneys, or those which, though secondary, become of primary importance, on account of the local or general disturbance caused.

GRAVEL.

What is gravel? — The occurrence of pulverulent or gritty matter in the bladder; and when discharged, producing irritation in the genito-urinary organs.

What are the symptoms? — They are of a twofold character, local nd general; the general are, dyspepsia, with disturbed circulation, with the usual signs peculiar to these affections.

What are the local signs? — A dull pain, and feeling of weight in the loins, darting pains in the extremities, and these pains increased by movements of the body; irritation and heat in the neck of the bladder, itching at the urethra, pain and retraction of one or both testicles, discharge of bloody urine, appearance in the urine of sandy powder of various colours, frequent calls to pass the urine, and difficulty of passing it; sickness accompanying the pains; and anxiety of countenance.

What is the character of the urine? — Scanty and high-coloured, high in density, and abounding in urea and lithate of ammonia.

Which is the most frequent kind of gravel? — The uric or lithic acid; and then we have next in order the phosphatic and oxalic gravel, &c.

What are the causes and pathology of urinary gravel?—These may arise from particular kinds of diet, and from organic diseases, either in the urinary organs or those of the digestive organs; or from constitutional causes; age also has its effects.

What kind of diet favours this affection? — Rich, nutritive, and solid diet, and this in excess, without the usual exercise necessary for an individual.

What articles of diet and drink cause this disease more frequently? — Articles that cause indigestion, or which are acescent, especially acescent wines; also, calcareous waters.

What are some of the other causes? — Injuries of the spine, and organic diseases, either in the organs of digestion or in the urinary organs. It may also arise from hemorrhoids, or from organic disease of the liver.

Does suppressed perspiration have any effect upon this disease? — Yes, it favours it.

Is not a strong constitutional tendency most influential in the cause of gravel? — Yes.

Does not gravel appear to be an hereditary complaint? — Yes.

Which is the least and which the most unfavourable species of gravel? — The lithic is the least injurious, while that composed chiefly of phosphate of lime is the worst, because we generally find organic disease of the mucous membrane of the kidneys or bladder accompanying it.

What other circumstances have an influence upon our prognosis in this disease? — The deposit yielding or not to the influence of judicious management.

What is the treatment? — This varies with the different species of gravel.

What is the object sought after in the case of lithic gravel? — To increase the quantity of urine, to lessen its density and its azotiferous principles, to substitute alkalinity for acidity, and to favour cutaneous secretion.

How would you favour these indications? — By diminishing the quantity and nutritive quality of the food; by increasing drink, and withholding acescent liquids; by the administration of alkalies, and by regular exercise; and by correcting the various morbid conditions in the constitution; and by warm clothing, &c.

Does the due regulation of diet have much benefit? — Yes; many cases of gravel are entirely relieved by it.

What articles of diet and drink are the best? — Milk and vegetable diet, and drinks of simple diluents.

Which of the alkalies are most used and beneficial in lithic gravel? —The bicarbonate of soda or potash, and the pure potash in solution.

In cases where there is dyspepsia, or undue excitement in the kidneys, what is necessary? — To remove the dyspepsia, and also to reduce the excitement in the kidneys by local or general depletion.

What remedies have been used to promote a discharge of gravelly deposits? — Turpentine, cantharides, and other stimulants to the kidneys; but they must be used with great caution.

What is necessary in phosphatic gravel? — Generous diet with nutritive articles, and sometimes a small quantity of wine, and attention to the condition of the bowels.

To what must we in all cases of gravel direct our attention? — Whether it depends upon an organic disease of the kidneys or bladder, or not.

How would you allay the pain occurring during fits of the gravel? — By opiates and antispasmodics, tonics, warm baths, &c.

What is the treatment of oxalic gravel? — The same as that for lithic, also avoiding all articles containing oxalic acid, &c.

In this form of gravel, is it not necessary for us sometimes to remove symptoms of inflammation? — Yes.

What has been suggested as advisable in this variety of gravel? — To endeavour to change this oxalic acid to the lithic variety, by means of muriatic acid internally administered.

URINARY CALCULI.

See Surgery, p. 367.

DIABETES.

What is meant by this term? — This has a twofold signification; the one when the urine is increased in quantity, and abounding with saccharine matter, and the other when the urine is merely increased in quantity, materially, uniformly, and independently of the administration of diuretics. To the former, the name of diabetes mellitus is given, and to the latter, that of diabetes insipidus.

Is the term diabetes insipidus at all significant or proper? — No.

What forms of the urine have been distinguished under this head? — By Dr. Willis there have been three designated, viz.; hydruria, or excessive watery discharge simply; and the deazotized, and the hyperazotized urine.

Is a simple uniform increase in the quantity of urine, from simple dilution, uncommon, or deserving the name of disease? — No.

Do we not sometimes have cases when the thirst is incessant and urgent, the flow of urine excessive, the appetite increased, and the general tone of the constitution impaired? — Yes; these are cases of real disease, and have been mistaken by some for cases of diabetes mellitus, but they are wanting in the essential elements of that disease.

Who are liable to this form of the affection, and upon what does it depend? — Young adults of the labouring classes; and it is supposed to depend upon deranged digestion, and want of nervous energy; but we cannot tell the cause of the primary disorder.

What is the best treatment for this form? — Tonics, mineral and vegetable, opiates, nutritious, but unstimulating diet, freedom from diuretics, and the proper regulation of the thirst for liquids; and purging with oleaginous and resinous articles, when necessary.

What are the characteristics of anazoturia? — Great paleness, absence of odour, diminution of density in the urine, with a feeble ammoniacal odour when kept, and deficiency of urea and the other solids.

What treatment has been recommended?—Gentle aperients, of the resinous or oleaginous kinds, bitter tonics, diaphoretics and anodynes, light nourishing diet, chiefly farinaceous and animal, and slightly acidulated drinks.

What is the last variety? — That in which we have an excessive secretion of urine, surcharged with urea. It has been termed azoturia.

What are the appearances of the urine in this form? — The urine is sometimes pale, at others deeper-coloured than natural; from four to sixteen pints is the daily quantity voided, high in density, and abounding in urea.

What are some of the general symptoms?—Irritability of the bladder, causing frequent calls to pass the urine, sometimes great appetite, gnawing sensations in the stomach, dyspepsia, laryngitis, debility, mental depression, and emaciation.

What are some of the causes of this affection? — High living, indulgence in alcoholic drinks, sexual excess, &c. In young children the causes are obscure.

What is the treatment of this form of disease? — If there is much excitement we must use venesection; food must be taken in moderation, and that which is easily digested, principally farinaceous articles; diluent drinks slightly acidulated; opium regularly administered; finally, invigorate the constitution, and bring about healthy secretions.

DIABETES MELLITUS.

What do you mean by this term? — A discharge of saccharine urine, with great tendency to emaciation and suppressed transpiration.

Are these phenomena constant? — No; but that of the presence of sugar in the urine is more so than any; but even this is not pathognomonic.

What are the symptoms of this affection? — These are always obscure, and the first sign is that of sugar found in the urine.

Is it probable that the disease only commences when sugar is found

in the urine?—No; but long before this we have reason to suppose that the kidneys are affected.

What are some of the marked signs?—Frequent evacuation of the bladder, and being disturbed frequently at night on its account; paleness of the secretion, and diminution of its proper odour; excessive appetite and thirst, deranged secretion of the skin, loss of flesh, and muscular power.

What is the general character of the urine?—This is increased in quantity absolutely, and also in relation to the fluid contained in the drink and food; it is increased in density, in solid contents, and in solids daily discharged, and also in its sensible and chemical qualities.

Can we detect sugar in the urine by the taste?—Not always, and hence it should not be depended upon.

Which is the best manner to detect the presence of sugar?—By fermentation with yeast; and by the test of heating the suspected urine with potash in a test tube, and adding a small quantity of a solution of sulph. cupri, when a brownish precipitate is formed.—[See *Chemistry.*]

What are some of the other properties of diabetic urine?—A tendency to early putrefaction, and the development of ammonia, deposition of earthy phosphates, spontaneous fermentation, and the presence of albumen.

What sometimes takes place in an uncomplicated case of diabetes about a week before death?—It sometimes becomes quite healthy.

What is the state of the functions of the alimentary canal?—Though some writers deny it, we nevertheless have not in incipient diabetes any affection of the stomach and alimentary canal, though when the disease has set in we have marked dyspeptic symptoms.

Where has sugar been found by a late observer?—In the stomach during digestion, in the half digested food, in the saliva and fæces.

What is the state of the circulation and the blood?—Generally in a state of excitement, and the blood has more or less of a buffy coat; the serum is whey-like, and the colouring particles diminish as the disease advances.

Has sugar ever been found in the blood?—No; but a syrupy fluid has been discovered, which has been fermented with yeast by McGrigor.

Is the skin affected?—Yes; it is dry, harsh, and rough, and, even where diaphoretics are used, perspires badly.

What is the state of the mind?—It is weakened and impaired; the faculty of attention is injured, and the patient becomes morose and irritable.

What are some of the secondary affections?—Tubercular phthisis, granular degeneration of the kidneys, anasarca, apoplexy, &c.

Is the pathology of this disease known?—No.

What do we most frequently find?—The kidneys enlarged, flabby, gorged with blood, with general enlargement of their vessels, &c.

What morbid appearances do we find in other parts of the body? —Tubercles in the lungs, and enlargement of the mesenteric glands.

Is this affection probably a functional or organic disease?—A functional; and from what it originates is still clothed with doubt, though many have supposed that error in diet is the chief cause, or derangement of the liver, &c.

What is the prognosis in these cases?—This varies with various circumstances; of the perfect cure of any we doubt much, but a fatal issue may be prevented from speedily taking place by proper treatment.

What are some of the fatal signs?—The accessions of pectoral complaints, the appearance of albumen in the urine, and sudden prostration of strength.

What is the treatment in this disease?—Bloodletting in its earlier stage, and then used in moderation; an animal diet, and this strictly adhered to; and for animal food, that of adult animals is preferable; and cooked by boiling or roasting, with little salt; the quantity of food should be regulated; and in regard to drinks, these should be small in quantities, and as simple as possible. Yeast and malt liquors may be used.

Is opium of importance in the treatment?—Yes, in doses of from a half to a grain, twice or thrice a day, and gradually increasing it to produce a gentle, calming effect.

Which one of the astringents has been found beneficial?—The plumbi acetas.

How would you restore the functions of the skin?—By means of pulv Dov., frictions, and warm baths.

What must be done in the various affections which may arise?—They must be treated on general principles.

What other remedies have been used?—Alkalies, the tonics, as cinchona, iodine, creasote, &c.

DIABETES CHYLOSUS.

What name has been given to this form by Dr. Willis?—Oleo-albuminous urine.

Is this a rare or common disease?—Rare.

Are the symptoms well marked?—No.

What, however, are some of the more prominent?—The milky appearance, its coagulating sometimes into a gelatinous body, and separation into a white clot, and a clear yellowish fluid; or there is simply a white flaky matter deposited; urea is defective, but not entirely wanting.

How are these symptoms frequently removed?—By inflammatory action in the kidneys, or by ptyalism.

Is this state of the urine continuous?—Not always.

What are its causes?—They are obscure; but luxurious living,

exposure to cold, extreme fatigue, and the constitutional action of mercury, have been assigned.

What is the nature of this disease? — This is not known.

What is the treatment? — Upon this point we are still in doubt; though that proper in other cases of diabetes has been adopted.

SUPPRESSION OF URINE.

What name has been given to this by nosologists? — Ischuria renales.

Is this properly a disease, or a symptom of various diseases? — A symptom.

Is the mere reduction of quantity to a slight degree in urine during the course of an acute disease of any importance? — No; it often occurs.

Is not extreme diminution, or entire suppression, dangerous? — Yes.

Do not the symptoms vary with the circumstances and with the cause of its suppression? — Yes.

When suppression takes place suddenly from any cause, during a state of health, or in any other circumstances than those of a pre-existing state of protracted chronic disease, what are the results? — Languor, restlessness, weariness, and pains in the loins and lower extremities; the pulse is excited, the skin is heated, features flushed, with headache, nausea, and vomiting.

Does not drowsiness soon supervene? — Yes; and this soon passes to coma, generally about the fourth day, and death soon follows.

What is the state of the bladder when examined with a catheter? — We have muddy urine loaded with mucus, or pale, and of a low density; and still later, we find the bladder empty.

Do we not find the quantity of urine gradually diminishing before we have complete suppression? — Yes.

What are the usual symptoms under these circumstances? — Simple coma, without any fever or convulsions, and death creeps on slowly.

What poisons sometimes produce suppression of urine? — Digitalis, corrosive sublimate, cantharides, &c.

What, probably, is the cause in these cases? — Irritation of the kidneys.

What other variety has been noticed? — That arising in young children, and in elderly persons who are troubled with lithic gravel, depending probably upon indigestion and nervous irritability.

What are some of the causes of suppression? — A blow over the parts adjacent to the kidneys, exposure of the lower part of the trunk to cold and wet, and from poisons taken inwardly.

What are some of the pathological appearances? — In sudden suppression we have darkness, flabbiness, and congestion of the kidneys, enlargement of the cortical portion, emptiness and contraction of the

bladder, urea in the blood; and in case of poison, we find evidences of inflammation; we also find granular disease of the kidneys, &c.

What is the treatment?—This differs with the various circumstances under which it occurs. If the suppression is complete we can do nothing, but if the urine is merely diminished, as in chronic organic disease, diuretics may be given by the mouth, and injections and counter-irritation over the loins, &c.

When we have reason to suppose that suppression occurs without previous organic disease, what may be done?—We may use blood-letting, with anodynes and diaphoretics, and purgative injections, but our remedies are all likely to fail.

ORGANIC DISEASES OF THE KIDNEYS.

Are the kidneys subject to many morbid alterations of structure?—Yes; but most of them are of rare occurrence.

Which are the principal organic affections?—Errors in conformation, hypertrophy, inflammation, granular deposition, hyperemia, anemia, atrophy, tubercles, carcinoma, hydronephrosis, and serous cysts.

Which are two of the most important, and of more frequent occurrence?—Inflammation and granular deposition.

INFLAMMATION OF THE KIDNEYS.

What are the various forms of inflammation?—Nephritis, or inflammation of the gland; pyelitis, or inflammation of the pelvis or calyces; perinephritis, or inflammation or the investing fibrous membrane; and pyelonephritis, when both the pelvis and glandular structure are affected.

What are the symptoms of simple acute nephritis?—The attack is announced as in other forms of inflammation, attended by pain in one or both loins, deep-seated and dull, aggravated by firm pressure, and by the sitting posture.

What effect has a violent sudden movement upon the parts?—It increases the pain.

Is the pain limited to the loins alone?—No; but it shoots down the ureters to the bladder, to the groin and scrotum; and we frequently have retraction of the testicles.

What is the state of the urine?—It is either suppressed or scanty, and it may be in great abundance, but voided with pain.

What is the character of the fluid?—It is sometimes bloody, or of a dark brown colour, and sometimes it is pale, almost like water, not acid, but rather neutral; sometimes also we have albumen present.

In what form of nephritis do we find the acids present?—In the asthenic variety.

Is pus or mucus present in the urine when we have pure nephritis?—No.

What are some of the other constitutional signs?—Great nausea

and vomiting, constipation, tympanitis, anxious and depressed countenance, &c.

What are some of the signs of the termination of nephritis?—Sometimes we have resolution without any new symptoms, or we may have signs of apoplectic coma.

Under what circumstances is coma apt to occur?—Where the urine is greatly diminished, or altogether suppressed.

When does death usually ensue? — Within three or four days after the supervention of the cerebral symptoms.

What are the other terminations? — Typhoid symptoms, which finally end in coma; and also suppuration may occur, indicated by rigors, followed by hectic fever, which may end in renal fistulæ, opening either externally or internally.

When gangrene takes place, what are the usual signs?—A diminution of pain, fluttering pulse, constant vomiting, hiccup, delirium, suppression, or a discharge of black, fetid urine, &c.

What are some of the signs of chronic nephritis? — These are obscure and indefinite; we seldom have pain, but an uneasy feeling may be aroused by pressure over the region of the kidneys.

Upon what must we chiefly rely for a diagnosis? — Upon the alkaline and turbid state of the urine, and upon the gradual wasting and emaciation of the patient.

Will local depletion and counter-stimulants have any effect in forming a diagnosis? — Yes; for by these means the alkalinity and turbid conditions of the urine are diminished.

What are the terminations of this form of the disease? — These are not well understood; but we may have it passing into the acute form, or into inflammation of the pelvis, and suppuration, and sometimes into induration, or atrophy.

What are the complications of the acute and chronic forms?—These may be as various as the different diseases to which the gland, as a whole, is liable, or to which the appendages of the glands are liable, including the ureters and bladder.

Mention some of the diseases particularly with which it may be complicated.— Cancer, diseased prostate, gonorrhœa, diseases of the uterus, &c.

Does this disease complicate other affections? — Yes; the liver, the duodenum, spleen, colon, and *vice versâ;* also pleurisy, pneumonia, and affections of the spinal cord and the brain.

To what diseases may nephritis arise as an intercurrent affection? — Typhoid fever, variola, yellow fever, and purulent absorptions.

What are the symptoms of pyelitis? — The pain extends to the testicles, and is attended with retraction of them; and when suppuration takes place, we may know it by manual examination; and sometimes we may distinguish fluctuation in the gland.

What is the condition of the urine? —Never suppressed, but fre-

quent calls to void it; and, when passed, it has an admixture of mucus or pus with it.

How may it terminate? — In resolution, suppuration, gangrene, or inflammation of the gland itself.

Is this form subject to many complications?—No; and is similar to those of nephritis.

What are some of the causes of these various diseases? — They may be caused by injuries inflicted upon the neighboring parts by blows or penetrating wounds; by exposure to cold and wet, and from the influence of irritating poisons.

What are some of the poisons which seem to have a peculiar effect in causing nephritis? — Cantharides, oil of turpentine, corrosive sublimate, digitalis, &c.

Does the co-existence of disease in the other urinary organs have any influence upon inflammation of the kidneys? — Yes.

What are some of the other influences? — Age, and the peculiar gouty diathesis.

Give some of the anatomical characters. — We have engorgement and redness or brownness present, enlargement of the bloodvessels, induration, and swelling of the kidney, purulent deposits, general softening of the cortical substance, &c.; and, in the chronic variety, the kidney is diminished, hardened, rugous, &c.

What are some of the anatomical characters in pyelitis? — The mucous membrane is vascular, with red spots of ecchymosis, and spots of lymph, &c.; and in the chronic form we have dull paleness, with enlarged and varicose vessels; the pelvis and calyces are distended, and membrane thickened, &c.

What is the prognosis of this affection? — This varies with the various causes producing the disease; as, when it arises in the course of other urinary diseases it is unfavourable, and when it arises suddenly during some chronic disease it is fatal.

Is it generally fatal when it occurs during the disease of the liver, lungs, spinal cord, or brain? — Yes.

In cases of coma, with prostration, &c., what is the prognosis? — Fatal.

Which are the least unfavourable cases? — Those cases caused by exposure to cold, and by injuries done to the parts near the kidneys.

What is the treatment? — A large bloodletting, and this repeated, if necessary, followed by an opiate, leeches and cups to the loins, warm hip-bath, and fomentations to the part; and, in chronic cases, counter-stimulants, and the usual antiphlogistic remedies, as calomel, and opium, &c.

What must be the diet? — Strictly antiphlogistic.

Is not rest indispensable? — Yes.

What are some of the special symptoms to be combated? — To reduce or increase the quantity of urine, but not by diuretics.

Are not diluents beneficial in the acute stage? — Yes.

What is proper in the chronic stage? — Here we may use diuretics, but not of the stimulant character; hence digitalis and bitart. of potash are the best.

What may be done in case of strangury, or frequent micturition? — In addition to the treatment already mentioned, we may use opiate clysters, opiate frictions, emollient injections into the urethra, and warm hip-baths.

Is there any specific treatment in cases where nausea and vomiting are present? — No; we must resort to the usual means proper in other cases.

Should we not turn our attention to the original cause of the disease in all cases? — Yes.

How would you alter the character of the urine in regard to alkalinity? — By administering the areated alkaline bicarbonates, and by directing our attention to the cause of the renal irritation.

Should not the bladder be frequently examined when we have retention of urine?—Yes.

BRIGHT'S DISEASE OF THE KIDNEY.

Who was the first to direct the profession to this form of disease? — Dr. Bright.

What is the peculiar state of the kidney? — The former opinion was, that a deposition of a yellowish granular matter takes place in its substance, together with gradual atrophy of its cortical and tubular structure; but, according to Dr. Johnson, the now accepted opinion is, that the fatty matter which, in the normal state, is in very small quantities in the epithelial cells, lining the uriniferous tubes of the cortical structure, is increased in quantity, and distends these tubes, so that groups of them constitute the small bodies, formerly called granulations. This deposit, pressing upon the capillary plexus surrounding the tubes, and the corpuscles of Malpighi, become passively congested; serum is effused, and blood escapes from the ruptured vessels, and both fluids escape with the urine. From the causes above mentioned, we have one part of the epithelial membrane under-excited, and others, over-excited, with active and passive congestion. The marked appearance of the kidney indicates a quantity of fat in different tubes. The ultimate atrophy of the kidney arises from absorption of organized tissue, consequent upon the pressure on the engorged tubes.

Is this a common or uncommon affection? — A common one; and is connected with a large number of acute and chronic affections, which may be ascertained by careful investigation.

How are the symptoms divided? —These may be divided into primary and secondary.

What are the primary symptoms? — These vary as the disease breaks out suddenly, or developes itself slowly; in the former instance, we have rigor, with the usual signs of inflammatory fever,

scanty urine, highly albuminous, occasionally bloody, and passed frequently and with difficulty; lumbar pain, rarely acute, pain across the pit of the stomach, with sickness and vomiting.

Does not dropsy soon occur? — Yes, and it is generally inflammatory.

What is the general course of the disease? — It either is checked soon, or proceeds to a fatal termination by the occurrence of some acute visceral inflammation, as pleurisy or pneumonia, pericarditis, or else in coma.

What is, however, the only invariable character? — Scanty and highly coagulable urine, with more or less fever.

How may the chronic form commence? — With acute symptoms, which soon pass off; or it may commence obscurely, with symptoms which scarce attract the patient's attention.

What is the condition of the urine at this time? — There may be either a scanty or a superabundant discharge of pale, or cherry-red, or brown, and often muddy urine, low in density, and coagulating with heat and nitric acid.

After the disease has existed thus for some time, how is the fundamental affection indicated? — By the strength being reduced, the body emaciated, the complexion of a waxy paleness or dingy, the skin dry and not perspirable, the patient is drowsy, and an enfeebled digestion and much thirst is present, while the blood has lost its colouring material to a great degree.

What are some of the secondary affections? — Dropsy, acute and chronic, visceral derangement, diarrhœa, rheumatism, catarrh, diseased heart, and coma.

What are the essential characters of the chronic form of granular disease? — Reduction in the density of the urine, diminished solids, reduction of the colouring matter of the blood, and leuco-phlegmasia generally.

Is the presence of albumen an invariable appearance? — No.

What are the characteristics of the urine depending upon the stage and form of the disease?—In the early stage and acute form we have a moderate reduction of density; the urine containing particles of epithelium, and loaded with fat. In the second stage the urine becomes albuminous; containing sometimes small particles of blood, and moulds of the tubuli uriniferi. The specific gravity is low, 1016, or lower. In the last stage the urine is sometimes very scanty or suppressed, or extremely abundant; and sometimes just before death the albumen disappears.

What do we find in the more chronic forms? — Reduction of density, some albumen, and the discharge of solid matter is also reduced.

What is the state of the blood? — In the acute stage the blood it buffed, and the serum lactescent and reduced in density; and as the disease advances, the colouring matter is greatly diminished; and

as the disease still farther advances, we have the blood still more changed.

What are some of the causes of this disease? — These are often obscure, but we may refer them sometimes to exposure to cold and wet, or to any of the usual exciting causes of the phlegmasia.

Do not constitutional circumstances clearly predispose to it?—Yes, viz.: intemperance, scrofula, and that state of the constitution following scarlatina.

Do not some articles which have a peculiar influence upon the kidneys favour it?—Yes, viz.: mercury, cantharides, and diet of pastry, cheese, and heavy puddings.

Has age, sex, or profession any influence upon it? — No.

What is the prognosis? — When taken in its incipiency it may be cured, but when allowed to advance far it is incurable.

Do not the secondary disorders have an influence in the prognosis? — Yes.

What is the general rule in regard to the fatality of this affection? — The danger is proportional to the lowness of the density of the urine, especially where the quantity is deficient.

What is a favourable circumstance?—Gradual increase in the density of the urine, its quantity remaining the same, or increasing.

What are some of the anatomical peculiarities? — When we have an acute form of the disease, in the first instance, we have the kidneys flabby, larger, and weighing more than natural; externally, dark and ecchymosed spots are seen, while within, we have them dark and full of blood, and also ecchymosed.

What is the condition of the cortical texture? — It is broader than natural, with a deposition of apparent granular matter; and when the case has existed for some time, we have the granular matter in great abundance, so as to conceal the striated appearance of the cortical portion of the kidney.

What is the condition of the bladder? — Contracted, containing a small quantity of urine, and that highly albuminous, and of low density, and the organs of the body generally are marked by inflammation, &c.

What takes place in the more advanced stages? — The cortical substance is seriously affected, and the internal portion is also much injured; the kidney is either diminished or enlarged; in the former case it is hardened, and in the latter softened and flabby. The investing membrane may be easily stripped off, and the appearance of the surface is pale, yellowish, or greyish-brown, and rough.

How is the inner portion of the cortical membrane? — It has almost entirely lost its striated appearance and reddish-brown hue, and has a very slight injection, if any; and the tubuli may have some specks of granular deposit upon them.

What is the condition of the other organs? — They present a

variety of morbid alterations, and vary with the secondary affections during life.

What do we find in the latter stages ?—The morbid signs are all increased.

How must we regulate the treatment?—We must first attend to the primary disease, and then to the secondary complications.

What is the treatment in the primary form ?—In the first instance antiphlogistics, both by venesection and local depletion, over the region of the kidneys; then we may resort to counter-irritants to the parts.

What must be done to favour cutaneous transpiration?—Diaphoretics and opiates, with warm baths, and gentle laxatives.

What is said of diuretics?—They are unnecessary except when dropsy prevails, or where coma is threatened, and when there is decrease of urine.

Is mercury beneficial?—No

When we have quieted the prominent symptoms, what is necessary to be done?—To enjoin a careful avoidance of cold and damp, abstinence from spiritous liquors and the like, the use of nutritive digestible food in moderation, the observance of regular exercise, and the use of the warm bath.

Is there any peculiar treatment for the secondary complications?—No; but they must be treated with great caution and care.

CYSTITIS, OR INFLAMMATION OF THE BLADDER.

What do you understand by acute cystitis?—Acute inflammation of the bladder, evinced by pain over its region, increased by pressure, with frequent and painful micturition, attended with fever, and pain extending to the neighbouring and conjoined parts. The abdomen becomes tense, swollen, and tender; nausea and vomiting are frequently present. The countenance is anxious and distressed; the pulse becomes small, frequent, irregular, and feeble; tongue dry; extremities cold; abdomen tympanitic; hiccough, coma, and convulsions supervene, and the patient rapidly sinks. In milder cases, the symptoms are modified. The urine is modified according to the greater or less virulence of the disease.

How are the symptoms modified according to the particular coat or portion of the bladder affected?—If the pain is burning, with a constant disposition to urinate, with a small discharge, and ardor urinæ and mucus present in the urine, the mucous membrane is probably affected. If there is pain over the pubes, and the contraction of the bladder painful or impossible, with little dysury, &c., we may diagnosticate inflammation of the peritoneal or muscular coat. If we have dysury, with great pain on the introduction of the catheter, and tenderness of perineum, and none at hypogastrium, inflammation of the neck of the bladder may be inferred. If tenesmus exists, the posterior part of the bladder is the part probably chiefly affected.

What are the causes of this? — Mechanical injuries, foreign bodies in the bladder, irritating injections; the undue use of cantharides, cubebs, or turpentine. It may also arise from any of the causes which may induce inflammation in any part of the body.

Treatment.

What is the treatment for this affection? — If it is very violent, and the patient can bear it, venesection is necessary; otherwise, the local abstraction of blood by cups or leeches; warm poultices over the parts. The bowels should be kept open by gentle aperients; mucilaginous cold drinks, in large quantities, when the mucous membrane is implicated; but when the peritoneal or muscular coat is involved, we should avoid them. Diaphoresis should be encouraged by alkaline diaphoretics and Dover's powder; anodyne enemata may be used; blisters should be used cautiously, and only in an extremity. Mercury may be resorted to, if the disease resists. The other remedies are, mercury in alterative doses, combined with opium and ipecac. The diet should be mild, mucilaginous, and farinaceous.

CHRONIC CYSTITIS.

What is the chief sign of this form of cystitis? — A discharge of mucus and epithelial scales from the bladder, more or less, either alone or mixed with blood, according to the stage of the disease.

What are its symptoms? — Generally more or less uneasiness in the bladder; weight in the perineum, with irritation of the rectum and anus, and frequent disposition to urinate, with sometimes only a small quantity passing, with pain and spasm of the bladder. In some cases we have slight fever.

What are the causes? — The same as those of the acute. It may be also induced by excessive venereal indulgence, or from a gouty diathesis, or over-indulgence in alcoholic stimuli, &c.

What is the treatment for this variety? — General bleeding is scarcely ever necessary. Small local bleedings may be used, and the treatment indicated in milder forms of the acute variety is here beneficial. When the disease is decidedly chronic, the turpentines may be employed. Buchu, uva ursi, and linseed infusions, are also beneficial. Injections to the bladder should be used cautiously. The mucilages, nitrate of silver, nitric acid, tar water, creasote, have been used. The diet should be as in the acute variety. The clothing about the lower part of the body should be particularly attended to.

HEMORRHAGES.

HEMOPTYSIS.

To what is this term applied? — To hemorrhage from the larynx, trachea, bronchi, or substance of the lungs.

Is not the quantity of blood lost various under different circumstances? — Yes.

What are some of the premonitory symptoms of active hemoptysis? Feelings of lassitude in the extremities, stricture across the breast, deep and frequent sighing, deep-seated pain under the sternum, a quick, small, frequent, and corded pulse, and saltish taste in the mouth, followed by a short cough, with blood following it.

May it not take place without any premonition? — Yes.

What is the character of the blood expectorated? — Florid and frothy.

When the blood comes from the fauces, do we generally have a cough preceding it? — No; but it is spit up.

Are not those who have once had an attack of hemoptysis more liable to it than those who have never had it? — Yes.

At what period of life is it most likely to occur? — Between the fifteenth and thirtieth years.

What persons are most liable to it? — Those of a weak or delicate pulmonary system, and who have narrow, flattened chests, high and prominent shoulders, long and slender necks, and, in general, those who have a predisposition to tubercular phthisis.

What are some of the exciting causes? — Change of temperature, suppression of habitual evacuations, metastatic gout or rheumatism, irritating substances acting upon the mucous membrane of the lungs, organic disease of the heart, blows on the chest, loud speaking, and particularly tubercles.

What is the prognosis in hemoptysis? — This depends upon circumstances. If the patient is scrofulous, or of a phthisical habit, our prognosis is unfavourable; but, when it occurs from pregnancy, or suppressed catamenial or hemorrhoidal discharges, other things being equal, we need not be alarmed. Those cases which arise from over-exertion of the body, producing strong pulmonary congestion or arterial excitement, are less likely to be dangerous than those which occur spontaneously.

How does the treatment of hemoptysis divide itself? — Into that proper during the flow of blood, and that after the bleeding is arrested.

When the pulse is frequent, tense, and hard, what should be done? — Use the lancet freely.

What internal remedies have been found beneficial? — Common salt, small doses of sugar of lead, nitrate of potassa dissolved in mucilage, alum, sulphuric acid, oil of turpentine, &c.

In cases where the pulse is irritated, small, and frequent, what remedies are highly beneficial? — Combinations of calomel and opium, or calomel, opium, and ipecacuanha.

Are not emetics beneficial? — Yes; especially ipecacuanha in small and repeated doses, where we have a hard pulse and much oppression in the chest.

When this disease assumes a chronic character, and with a pulse irritated, what remedy has been found of value? — Digitalis in small doses, combined with aconite and colchicum.

What external applications have been made in these cases? — Blisters, rubefacients, pustulating with tartar emetic ointment, &c.

What, however, should we principally bear in mind in case of hemoptysis? — The nature of the exciting cause.

When hemoptysis occurs in consequence of suppressed hemorrhoidal discharges, what should be done? — Endeavour to reproduce them by leeches to the anus, an aloetic pill, and by a proper regulation of diet, and moderate exercise.

What remedies have been used when hemoptysis occurs in young females from menstrual irregularities? — Tr. cantharides, venesection, blisters to the sacrum, warm hip-bath; but the stimulating emmenagogues must be avoided.

When the deranged state of the menses occurs from a chlorotic state of system, what must be done? — We must resort to the ferruginous preparations, a nourishing diet, with a gentle aperient aloetic pill.

HEMATEMESIS.

What do you mean by this term? — Hemorrhage from the stomach.

What are the signs of this affection? — Weight in the epigastrium, loss or voraciousness of appetite, pain and tenderness in the hypochondria, nausea, anxiety, &c.

What is the state of the circulation? — We have a small, weak, and irritated pulse, with alternate flushes of heat and chills over the body, cold extremities, a pale and contracted countenance, with great anxiety, and at length a copious ejection of blood follows.

What is the character of the blood thrown up? — In general it is of a dark colour, sometimes in coagulated clots, and at others quite fluid, and occasionally florid.

What is the character of the blood thrown off in malignant fevers? — It resembles coffee-grounds suspended in a glairy fluid.

From what is this supposed to arise? — From inflammation and abrasion of the mucous membrane of the stomach.

What is the quantity of blood thrown up? — In some cases it is very great, in others very small in amount, and at other times it may pass off entirely by stool, and not any escape by the mouth.

May not paroxysms of hematemesis frequently occur? — Yes.

How is the patient left after each paroxysm? — If the paroxysm is not fatal, we have much exhaustion present, but the load at the stomach is much relieved.

Whence does the blood come from in hematemesis? — Generally from the mucous membrane of the stomach, but sometimes from the liver or spleen.

What are some of the causes of hematemesis? — Obstruction to

a free circulation of blood in the abdominal viscera, induration of the liver and spleen, suppressed hemorrhoidal discharges, menstrual irregularity in females. It may also be produced by corroding substances in the stomach, blows upon that organ; and it may also arise in the last stages of malignant fevers.

What is the prognosis of this affection — When arising from suppressed hemorrhoidal or menstrual discharges, it is not to be considered dangerous, unless recurring frequently. It is more dangerous when it arises from visceral obstructions, or in the last stages of malignant fevers, or in corrosion of the stomach, either by poisons or from other causes.

What is the treatment in this affection?—When the circulation is increased we must use the lancet freely, counter-irritants must be placed over the stomach, and upon the lower extremities, dry cupping and leeching over the stomach are sometimes highly beneficial.

Are not laxative enemata and purgatives of benefit in this affection? — Yes.

Have emetics ever been used with advantage? — Yes, particularly ipecacuanha.

What astringents have been found beneficial in this disease? — Plumbi acetas, gallic acid, spts. of turpentine, cold water, and the vegetable astringents generally; and in the debilitated, tr. ferri muriat

What should be the character of the diet of the patient? — Of the very lightest kind, with drinks of a bland, cooling, and acidulated character, and ice should be freely given.

HEMATURIA.

What is meant by this term? — Hemorrhage from the urinary organs.

Is it not difficult to tell from what part of the urinary apparatus the blood proceeds? — Yes.

What are some of the diagnostic marks of the flow of blood from the several parts of the uninary apparatus? — When we have blood coming from the kidneys or ureters, we generally have much greater lumbar pains than in other varieties, and the blood is intimately mixed with the urine, so as to give to it a uniformly red appearance; when from the bladder, it usually comes away in clots or flocculi, and floating in the urine, and is accompanied with pain, a sense of fulness and tenderness of the pubic region, with burning around the neck of the bladder, &c.; when from the urethra, we have none of the before-mentioned symptoms, the blood is passed without any mixture with urine, or any effort at its evacuation.

May not this hemorrhage occur periodically? — Yes; especially when it comes from the neck of the bladder, or is vicarious to an hemorrhoidal discharge.

Who is hematuria more likely to attack? — The aged, and those of a gouty diathesis, or plethoric and corpulent women, about the final

cessation of the menses; and it may also occur in young children during the period of dentition.

What are some of the causes of this affection? — This may be excited by calcareous concretions in the kidneys and bladder, or by acrid stimulating diuretics, as cantharides, ol. terebinth, &c., or from scirrhous ulcerations, and vascular and fleshy tumours in the bladder, ureters, kidneys, &c.

When does hematuria assume the most unfavourable aspect? — When it occurs in the latter stages of violent fevers.

Is hematuria considered at all dangerous when it occurs vicariously in the place of an hemorrhoidal discharge or menstruation? — No.

Are not persons liable to a return of this disease when they have once had it? — Yes.

What is the treatment in this disease? — In plethoric and young subjects we must resort to venesection; and when the hemorrhage arises from calculous irritation in the kidneys, the warm bath, with opiates, are decidedly beneficial; cupping over the kidneys has been resorted to with good effect.

What other remedies are beneficial? — Mucilaginous drinks and the milder diuretics, as the uva ursi, or parsley root, &c.

Is not perfect rest necessary in cases of hematuria? — Yes.

Should not stimulating diuretics in all cases be avoided? — Yes.

EPISTAXIS.

What is meant by this term? — Bleeding from the nose.

What are the causes of epistaxis? — Anything which may have a tendency to cause a preternatural flow of blood to the head; viz., great straining, blowing on wind instruments, a dependent position of the head, &c.

Mention some other causes? — Suppression of the menstrual and hemorrhoidal evacuations; and it may occur in that thinned state of the blood following copious sanguineous depletion, &c.

Is epistaxis of much consequence if it is not symptomatic of some serious visceral or general affection? — No.

What is the treatment? — If the hemorrhage occurs as vicarious to the menstrual and hemorrhoidal discharge, it should not be stopped unless it becomes excessive, and this rule should be adopted in all cases where we have an active pulse with great cephalic congestion.

What may be done if we have the system in a very excited state? — Use the lancet, elevate the head, and administer the cooling purgatives, with cold drinks, &c.

In moderate cases of epistaxis, what remedies have been found beneficial? — Cold to the head, and warm bath to the feet, a dossil of lint in the nostrils, either perfectly dry, or wet with some styptic, or oil of turpentine.

What internal remedies have been resorted to? — Sugar of lead, gallic acid, &c.

AFFECTIONS OF THE BRAIN.

INFLAMMATION.

How do you divide inflammation of the brain? — Into meningitis, or inflammation of the membranes of the brain; and cerebritis, or inflammation of the substance of the brain.

What are the symptoms of inflammation of the pia mater and dura mater? — There is great pain in the head, with feelings of fulness, the eyes are red and suffused, and the countenance flushed, the stomach is affected, delirium soon appears and becomes very great, and the whole system is in a restless condition, the pulse at first is firm and full, but afterwards it becomes small, tense, and sometimes intermitting, and the respiration is at first hurried and anxious, then slow, deep, and laborious.

Do not other organs become implicated? — Yes, particularly the liver.

What are some of the causes of this variety of inflammation? — It may occur during the course of any of the general fevers; or from the sudden influence of cold while the body is over-heated; also from violent passions, the sudden suppression of habitual discharges, metastasis of gout, erysipelas, &c.

What is the prognosis in this affection? — Generally unfavourable.

What is the pathology? — We have evidence of inflammation on the pia mater and dura mater, with flakes of coagulable lymph, and pus mixed with serum upon them.

What is the treatment in this variety of the disease? — Vigorous antiphlogistic; bloodletting, locally and generally, and this repeated; iced applications to the head; saline purgatives, &c.

Are not the mercurials beneficial in this form of the affection?—Yes.

When are blisters to the nucha beneficial? — When the violent inflammation is first moderated by bleeding, &c.

What internal antiphlogistics have been used? — Nitre, in combination with antimony, digitalis, &c.

What is proper to be done in regard to the apartments of the patient? — They should be kept dark, silent, and cool, and everything avoided which disturbs the quiet of the patient.

What must be the character of the diet? — Mild and simple.

ARACHNITIS.

What are the symptoms of arachnitis? — At first, we have the patient wakeful and irritable, with a great repugnance to a strong light; and, in children these symptoms are more marked than in the adult; soon, however, we have transient pains in the head, greater irritability of temper, the pulse is irritated, quick, tense, and active; the countenance indicates distress, and there are flushed cheeks, and contracted eyebrows present, &c.

What are the symptoms in the more advanced stages? — The delirium is more continuous; the countenance exhibits signs of stupor·

the conjunctiva is suffused and red, and there is great somnolency; the mind is torpid, and, finally, coma supervenes.

Are these symptoms always present? — No; sometimes the patient is attacked very suddenly.

Do not convulsions often occur in young children? — Yes.

What organs of the body seem more particularly to sympathize in this disease? — The stomach, liver, and kidneys.

What are the characteristics of the alvine discharges in this affection in young children? — Mostly like chopped spinage.

What are some of the post-mortem appearances in this disease? — The arachnoid membrane is minutely injected, or opaque and thickened, and serum is effused in the ventricles of the brain and on its surface.

What are the causes of arachnitis? — There appears to be in some an hereditary predisposition to it; and children of a weak and nervous temperament are peculiarly liable to it; and it may also be caused by blows on the head, repelled eruptions and suppressed habitual evacuations, or from great mental application, &c.

Who are more liable to this disease? — Children.

What appear to be the peculiar exciting causes in their cases? — Dentition, with great intestinal irritation.

What are the principal points to be borne in mind in the treatment of this disease?—To moderate the general arterial action in the brain, and to remove all articles which have a tendency to keep up a preternatural determination of blood to the head.

How would you answer these indications? — By venesection and local depletion; ice to the head, and the administration of small doses of calomel, followed by saline purgatives, and their action kept up by milder laxatives.

Are not the mercurials in alterative doses beneficial? — Yes.

Are not blisters beneficial? — Yes, when the inflammatory symptoms are partially relieved.

Where would you apply them? — Behind the ears, and to the back of the neck.

What should be the character of the diet? — The very mildest.

CEREBRITIS.

What are the first symptoms of this affection? — A fixed and violent pain in the head, continuing for several months, with vertigo, obtuseness of the mental faculties; the patient is dejected and querulous; the vision is perverted, and hearing is dull, and there is an indifference to surrounding objects; the pulse is full and hard, and sometimes intermitting; and occasionally there is temporary delirium, with fever, and much agitation.

What symptoms now occur? — A gradual or sudden paralysis of a limb, or of half the body, while the consciousness and intellect still remain; or we may have coma and convulsions.

May not convulsions, occurring in paroxysms at short intervals, be the first symptoms of alarm? — Yes.

What do we generally find as post-mortem appearances in this disease? — An injected state of the membranes of the brain, with softening of its substance.

Is the cause of softening of the brain fully determined?—No; the most probable causes are — 1st. Cerebral inflammation; 2d. A defect of circulation in the brain from a diseased state of its arteries.

In whom do we find softening of the brain the most common?—In the aged.

What is the treatment in *cerebritis?* — General and local bloodletting, sinapisms to the feet, and cold to the head, together with active cathartics, and blisters to the back of the neck.

How would you administer calomel in this disease? — So as to produce ptyalism as speedily as possible.

Notwithstanding our best efforts, is not this disease generally fatal? —Yes.

APOPLEXY.

What are the premonitory symptoms of apoplexy? — Sometimes the attack comes on suddenly, but frequently we have vertigo, a dull, deep-seated pain, or sense of weight in the head, particularly in stooping, with a turgid state of the veins of the head, throbbing of the temporal arteries, ringing in the ears, drowsiness, disturbed and heavy sleep, and dimness of sight.

May we not have paralysis as one of the first symptoms? — Yes.

When an apoplectic attack has taken place, what are the signs? — At first the pulse and respiration are weak, and often scarcely perceptible; but they soon change their character, and the pulse becomes full, slow, regular, and often hard, and the respiration slow, oppressed, and interrupted, and stertorous, and often with a puffing out of the lips; the face is sometimes livid and turgid with blood, but more frequently it is pale and bloated.

What is the condition of the extremities and surface of the body? — The extremities are cold, but the surface generally preserves its temperature.

What is the condition of the bowels? — Torpid.

How may apoplexy terminate? — Either in death or in perfect restoration of all the suspended functions of the body, or in paralysis of certain parts of the body; or we may have a general febrile condition of the system taking place.

What is the prognosis in apoplexy? — Unfavourable.

What are some of the predisposing causes of apoplexy? — 1st. A peculiar conformation of the body, viz.: a large head, thick, short neck, broad shoulders, ample chest, florid, full face, &c.; 2. Age — it generally occurring between the fortieth and sixtieth years; 3. Whatever tends to produce general plethora; 4. Organic affections of the heart, &c.

What are some of the exciting causes of apoplexy? — Anything

which produces inordinate determination of blood to the head, or impedes its free return from the brain to the heart, viz.: over-distension of the stomach, when the digestive powers are weak; the intemperate use of spirituous liquors, violent exertion, a stroke of the sun, &c.

What are the post-mortem appearances in apoplexy? — 1st. Vascular turgescene of the brain; 2d. Sanguineous extravasation in the substance of the brain; 3. Effused serum in the ventricles and on the surface of the brain; and sometimes we discover nothing.

What is the treatment in apoplexy? — Bloodletting, both locally and generally, and this carried to a great extent; take all ligatures from every part of the body; cold applications to the head, and warm, stimulating ones to the feet; active purgatives, particularly the saline, should be administered, also calomel in large doses; active purgative enemata are also highly beneficial.

What should be the diet in apoplectic cases? — Of the very mildest character.

What advice should be given to individuals who have a tendency to apoplexy? — That they should refrain from everything of a stimulating character, and live upon a simple, abstemious diet, take exercise in the open air, and, if their bowels are torpid, use some mild and gentle laxative; and should any of the premonitory symptoms of apoplexy occur, resort immediately to venesection.

Should habitual, hemorrhoidal, or other discharges be checked, if they are not excessive? — No.

Should individuals who have a tendency to apoplexy bathe their feet in cold water? — No.

PARALYSIS.

What is meant by paralysis? — An impaired or abolished power of voluntary motion or sensation, or both, in certain parts of the body, without coma or loss of consciousness.

How many kinds of paralysis are there? — Hemiplegia, or paralysis of half of the body; paraplegia, or paralysis of the inferior extremities; paralysis partialis, when only a particular part of the body is affected; and paralysis agitans, or shaking palsy.

Is paralysis of the whole body of frequent occurrence? — No.

Which is the most common kind of paralysis? — The hemiplegic.

What is the cause of it? — Pressure upon the base of the brain, similar in character to that we find in apoplexy.

What are the premonitory symptoms of hemiplegia? — Those of apoplexy.

What are some of the immediate precursory symptoms of an attack? Flushed face, distension of the bloodvessels of the head and neck, vertigo, fulness in the head, weight and pain in the head, ringing in the ears, drowsiness, loss of speech, &c.

Do the other organs of tho body frequently sympathise in this disease? — No.

What is the general course of an attack of hemaplegia? — Often

little or no improvement takes place, and the patient dies from exhaustion, or from apoplexy; or the patient may gradually recover the use of his side.

PARAPLEGIA.

How does paraplegia usually occur? — It generally comes on gradually, and when it arises from an affection of the brain, we have the symptoms of hemiplegia in a modified form.

What are some of the symptoms occurring in the lower extremities? — We have a feeling of heaviness and numbness, with a stiff and awkward motion in the lower limbs, which gradually increases until the patient is unable to move them.

What is the condition of the bowels and urinary organs? — The bowels are generally constipated; but when the sphincter ani or vesicæ are palsied, the fæces pass off and the urine dribbles away involuntarily.

Does not paraplegia more frequently occur in children from a lesion of the spinal marrow? — Yes.

When paraplegia from cerebral affections occurs, in whom do we find it most common? — In males, after the forty-fifth year.

PARALYSIS PARTIALIS.

What are some of the instances of partial paralysis? — Paralysis of the muscles of one side of the face or the under-lip, or the eyelids; the different sphincters, the erector muscles of the penis, &c.

What are some of the causes of the different forms of paralysis? — Those common to apoplexy, as pressure on the brain or spinal marrow; and in partial paralysis, in addition to the preceding cases, we may have injury of a particular nerve, and the action of lead upon the system.

Do we know definitely the real cause of shaking palsy? — No; nothing more than that of a deranged nervous system.

What is the treatment in paralysis? — Bleeding locally and generally, purging, emetics, revulsive applications, as blisters to the back of the neck, and sinapisms to the feet and ankles; and in cases of paraplegia, stimulating enemata are highly beneficial.

When the symptoms of undue determination of blood to the head have been relieved, what remedies may we resort to? — Frictions, stimulating liniments, electricity, galvanism, and occasional blisters to the legs.

What remedies have been used internally in this stage of the disease? — Nux vomica, or its preparation, strychnine; the rhus toxicodendron has also been used; so, also, ol. terebinth, canabis indicus, &c.

DROPSY.

What do you understand by dropsy? — An accumulation of a preternatural quantity of serous fluid in some one or more of the natural serous cavities of the body, or in the interstices of the serous cellular tissue.

Is dropsy more a symptom of disease than a disease itself? — It is more a symptom, but on account of the importance of the symptom, we are to look upon it as a disease, and treat it accordingly.

What was Dr. Rush's opinion of the cause of dropsy? — An increased action of the exhalent vessels, attended with a general pyrexial condition of the system.

What are the only points considered proved in the theory of dropsy? — First, that the balance between exhalation and absorption is broken, in consequence of which more fluid is poured out than is taken up; and secondly, that this may take place from over activity, or from debility of the general system.

What may be the characters of dropsies? — Acute or chronic, idiopathic or symptomatic, primary or secondary, general or local, inflammatory, sthenic, asthenic, &c.

What are the exciting causes of acute dropsy? — The repression of eruptions, sudden suppression of perspiration, suspension of the catamenia, or any customary evacuation, inflammation of the lungs, and pleura, exposure to cold, &c.; it may succeed scarlatina.

What are the secondary, or symptomatic dropsies?—Those arising from disease of the heart, disease of the lungs, diseases of the liver, spleen, and pancreas, and disease of the kidneys; that arising from the use of arsenic, &c.

What names have been given to the principal forms of dropsy? — Ascites, or dropsy of the belly; hydrothorax, or dropsy of the chest; hydrocephalus, or dropsy of the head; anasarca, or dropsy of the whole cellular tunic, &c.

ASCITES.

What are the diagnostic marks of ascites? — Swelling of the abdomen, and this occurring gradually from below upwards, and equally on both sides, also the peculiar feeling communicated to the fingers by pressure, and by percussion, palpation, and we also may be guided by the antecedent history of the patient.

With what is ascites liable to be confounded? — With pregnancy and encysted dropsy.

What are the usual divisions of ascites? — Into idiopathic acute ascites, idiopathic asthenic, and sympathetic.

What are the diagnostic marks of the first variety? — These differ with the exciting causes and the constitution of the patient; sometimes it occurs suddenly, without any precursory symptoms, at others we have inflammation of the peritoneum, with the usual signs of fever, pain on pressure, &c., it may also occur after scarlatina, &c.

What are the marks of the second variety?—It generally succeeds exhausting discharges, as profuse hemorrhage, diarrhœa, &c., and generally commences with œdema, in the lower extremities, and occurs in persons of a pale, weak, feeble habit of body, and more frequently occurs in females.

What is the cause of the sympathetic or consecutive ascites? —

This is always the result of some previous disease in some important organ of the body, as the heart, liver, kidneys, &c.

What is the treatment of ascites? — This will vary with the origin of the disease in the idiopathic acute form, bleeding locally and generally is to be used; mercurial purgatives should be administered, followed by diuretics, as the digitalis, and followed with great caution by tonics. In the idiopathic asthenic, we must endeavour to remove the exciting cause, and for this purpose, tonics are decidedly beneficial, commencing with the milder vegetable bitters, and gradually increasing their strength, followed by the mineral tonics, and using diuretics, sometimes combined with blue pill, as the digitalis, squill, liquor ammon. acetatis, and frequently changing our remedies, and in the sympathetic variety we must remove the original disease if possible, and use, for the purpose of removing the dropsical effusion, the strongest drastics, as elaterium, gamboge, croton oil, &c.

Can paracentesis be depended upon as a curative agent? — No.

HYDROTHORAX.

What do you mean by hydrothorax? — This term is now confined to an effusion of serum into the cavity of the pleura.

Upon what does it generally depend? — Upon inflammation of the pleura and upon affections of the lungs and heart.

What are its symptoms? — In those cases which follow pleurisy we must call to our aid percussion and auscultation, and in cases arising from disease of the heart and lungs, in addition to the symptoms peculiar to affections of the heart, made manifest by percussion and auscultation, we have the feeling of dyspnœa, difficulty in taking exercise and inability to lie down; all increased by the supervention of the effusion; and in cases arising from pneumonia and bronchitis, we have nothing more especially remarkable than increased dyspnœa, and in these cases the termination is not as sudden, neither do we have as purple or a livid hue of the countenance, as in those arising from heart affections.

What are the signs presented by auscultation and percussion?—In auscultation, when the fluid is small in quantity, we have the peculiar sound of the voice called œgophony; this, however, exists only for a short time, if at all, and then we have want of respiratory murmur, except at the root of the lungs; in percussion, we have a dull and flat sound, returned in proportion to the extent of the effusion; we should, however, always bear in mind in making our diagnosis, to take the rational and physical signs conjointly.

Is admeasurement of advantage in our diagnosis? — Yes.

With what diseases may hydrothorax be confounded?—With solidification of the lungs, either by tubercles or otherwise, and tumours in the cavity of the pleura.

What is the prognosis in this disease? — Generally unfavourable to a perfect cure.

What is the treatment in hydrothorax? — This varies with the

original cause of the affection, whether it arises from the heart, lungs, &c., but when any inflammation does occur in the course of the disease, we must resort to bloodletting by cups and leeches, and cautiously by the lancet; purgatives and diuretics are of decided benefit.

What is the general opinion in relation to paracentesis? — It may be used as a means of relief in the latter stages, when the accumulation of water is great, but the resort to it as a means of cure is now generally abandoned.

HYDROCEPHALUS.

What do you understand by this? — An effusion of water within the cavity of the cranium.

Where is the effusion more likely to take place?—In the ventricles of the brain; or, more rarely, in the sac of the arachnoid.

How has it been divided? — Into acute and chronic.

What is now generally supposed to be the cause of hydrocephalus? — An acute or subacute inflammation of the serous membrane of the brain.

What are the general precursory symptoms of the acute variety?— Among the first are a derangement of the digestive organs, as want of appetite, furred tongue, unnatural appearance of the stools and urine, and the cutaneous circulation loses its vigor; we have a languid manner present, with drowsiness, disturbed and restless sleep, pains in the head, with giddiness; the patient becomes silent, irritable, and indifferent to surrounding objects; after a while, we have flushing and chills frequently occurring, the gait becomes laborious and awkward, and the pulse rapid, frequent, and tense.

What are the various forms of attack? — In addition to what has been remarked as precursory symptoms, we may have the disease come on rapidly, with high febrile excitement, flushing, severe headache, increased sensibility of the retina, and of the whole nervous system, with pain in the abdomen, and tenderness on pressure, with vomiting on motion, &c.; or the disease may occur after scrofula, or painful dentition, the exanthemata, remittent fever, or hooping-cough; and its approach, in these cases, is very insidious.

Into how many stages has hydrocephalus been divided? — Three; viz., according to Cheyne, 1st, that of increased sensibility; 2d, that of diminished sensibility; and the 3d, that of palsy, or convulsions. (It may be proper to remark that some cases occur, in which this nor any other division is marked.)

What is the prognosis in this disease? — Generally fatal.

What are the general appearances on dissection? — Inflammation of the arachnoid membrane, increased vascularity in the substance of the brain, with softening of its substance, and effusion into the ventricles, &c.; and, in late years, it has been considered a tubercular meningitis.

What are the predisposing causes of this disease? — The period of life, it generally occurring during infancy and in childhood, especially

when there is a strumous diathesis present. Also, disorders of the digestive or respiratory organs, difficult dentition, scarlatina, and all diseases which induce debility, or excite febrile action in the system, too great use of narcotics; also external injuries to the head, the extension of inflammation from the external ear, repression of sudden discharges, or drying up of old sores, &c.

What is the general plan of treatment to be observed?—In the first place we must commence the treatment early in the precursory stage, if we hope to effect anything, and first of all we must resort to bloodletting, locally and generally, and repeated according to circumstances; purgatives should also be employed, especially calomel, in combination with jalap, followed by saline purgatives; cold should be applied to the head, and mercury as an alterative has been used with decided benefit, and deserves attention. Blisters are highly recommended; and, as palliatives, digitalis, antimony, opiates, squills, and colchicum; and the diet should be of the very mildest kind.—[See *Cyc. Pract. Med., Pa. Edit.*]

CHRONIC HYDROCEPHALUS.

How may this occur?—Either as an acquired or congenital affection; acquired, when it arises as a sequel of the acute; and congenital, arising from some malformation or defective development of the brain.

What are the signs of this disease?—Enlargement of the cranium, sometimes so great as to cause the patient to rest the head upon the shoulder, the sutures and fontanels may be open, and sometimes fluctuation may be felt.

What are the symptoms of chronic hydrocephalus?—When the disease comes on subsequent to infancy, we have unusual excitability of the nervous system; excessive muscular debility; epileptic fits are apt to occur; heaviness and pain in the head; by pressure on the fontanels we may produce stupor; the pupils of the eyes become enlarged; and frequently the senses of taste and touch may alone remain; the functions of the digestive organs are impaired; and as the disease advances the pulse and respiration become affected; there is debility and loss of power in the voluntary muscles, with automatic motions of the limbs; there is an inclination to keep the head lower than the body, or buried in a pillow.

What is the prognosis in this variety?—Unfavourable, when allowed to advance far.

What is the treatment?—Though this will almost always fail, we may resort to diuretics, purgatives, and diaphoretics, together with mercury, tonics, and strengthening diet; externally keep the head warm, and apply aromatic embrocations and blisters, and counter stimulant ointments; tapping the head has also been recommended, and lately with some appearance of success.

ANASARCA.

What do you understand by this?—An effusion of serum into the meshes of the cellular tissue.

What is one of the principal signs of anasarca?—The pitting of any part in which effusion has taken place from firm pressure by the fingers.

What is the prognosis in these cases?—It is not attended with much danger when simply idiopathic.

When may anasarca occur?—Frequently as an acute disease, but even in such cases it is usually accompanied with inflammation of some organ.

What are its causes?—It may arise from sudden exposure to cold, to suppressed perspiration, &c.; but it more frequently occurs from repelled eruptions, after scarlatina, and measles, &c.; from Bright's disease of the kidneys; from disordered menstrual secretion; sometimes from suppression of habitual hemorrhoidal discharges; and sometimes it occurs about the time of the cessation of the menses; or from excessive menorrhagia; but the most common cause is organic disease of the heart; and cases of partial dropsies may arise after intermittent fever; from mere obstruction to the circulation in any part of the body, as by ligatures upon the limbs, or from obstruction of the circulation in the femoral vein by inflammation, causing phlegmasia dolens, frequently occurring in females; and dropsy may also occur, generally from the long-continued use of arsenic.

What is the treatment in anasarca?—This will vary whether it occurs after an organic affection or not, and then the treatment proper in such cases must be pursued, but if it arises in the simple acute febrile variety, we must resort to venesection, and cups locally over the loins to prevent injury to the kidneys, followed by a warm bath, and a diaphoretic mixture; and if diarrhœa or dysentery does not exist, purgatives are of advantage; diuretics if used at all should be used with caution, if the anasarca arises from cardiac disease, in addition to the remedies peculiar to that form of disease, we may prescribe diuretics with advantage. If the dropsy arises from anemia, we must strengthen the patient's system by tonics, nutritious food, fresh air, &c.; if from affections of the kidneys, the application of cups over the loins will be found advantageous, followed by cathartics, warm bath, or hot air baths, and diluent drinks, and if absolutely necessary, we may resort to the diuretics least likely to stimulate the kidneys, as potas. bi-tart. and digitalis.

What mechanical means have been resorted to when the distension is very great and tense?—Bandaging with a roller, and acupuncturation.

What are the principal cathartics that have been used in dropsy?—Potas. bi-tart, elaterium, gamboge, jalap, sulphur, &c.

What are the chief diuretics?—Squill, digitalis, acetate of potash, nitrate of potash, cantharides, juniper berries, colchicum, Indian hemp, &c.

PART V.

CHEMISTRY.

What is chemistry? — Chemistry is that science which treats of the composition and relation of ponderable substances; and of phenomena arising from the reaction of their particles.

What is meant by ponderable substances?—Such as can be weighed; including solids, liquids, and gases.

What are the imponderable substances? — Heat, light, electricity, and magnetism.

How is chemistry divided?—Into organic chemistry, or that which treats of substances of animal or vegetable origin; and inorganic, or that which treats of substances belonging to the mineral kingdom.

PHYSICAL CONSTITUTION OF THE ATMOSPHERE AND GASES.

What is the state in which all things on the surface of earth exist? — At the bottom of an ocean of gaseous matter, which envelopes and presses upon everything.

Are not gases operated upon by gravity? — Yes.

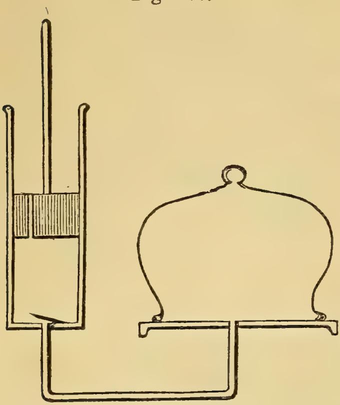
What is one of the prominent characteristics of gases? — They are highly elastic; upon this principle depends the value of the air-pump.

By what law is the compression of air or gases governed, and also all vapours of volatile liquids when remote from their points of liquefaction? — The volume of air or gas is inversely as the compressing force; and the density and elastic force are directly as the pressure, and inversely as the volume. This has been termed the law of Mariotte.

What is the construction of the air-pump? — A cylinder, in which moves a tightly-fitting piston by means of a rod. The bottom of the cylinder is connected by a pipe with any vessel to be exhausted; at

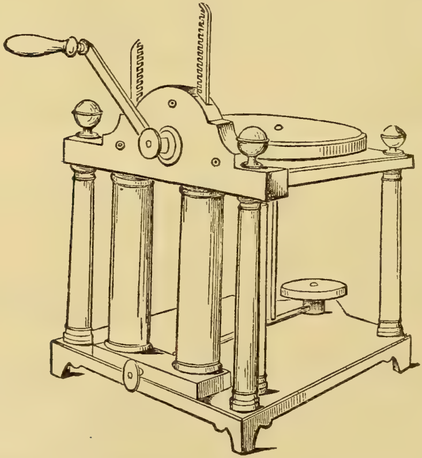
the bottom of this cylinder is a valve opening upwards. (Fig. 250.) A similar valve is fitted in the piston, also opening upwards. When the piston is raised the valve on its surface is closed by atmospheric pressure, and a vacuum is created in the cylinder; the air in the vessel to be exhausted, expands, and forces up the other valves, and fills the cylinder. The piston again descending, the lower valve is closed by the pressure of the air in the cylinder, and the valve in the piston is opened, allowing the air to escape; and by repeating this motion of the piston, the air can be almost entirely exhausted from the receiver. In practice, it is usual or convenient to have two such cylinders as seen in the adjoining cut. (Fig. 251.)

Fig. 250.



Does not the air have weight?—Yes; this is proved by first weighing a flask filled with air, and afterwards exhausting the air from it by the air-pump, and comparing the difference of weight.

Fig. 251.



How may the pressure of the atmosphere be shown?—By tying a piece of bladder over the mouth of an open glass cylinder, and then

exhausting the air from beneath it; when it will gradually become more and more concave until it suddenly bursts.

Is not the force of the air equal to its pressure?—Yes; otherwise, everything containing air would break spontaneously.

What is the principle of the construction of the barometer by Torricelli, made in 1643?—That by knowing the density of a liquid in a tube, and the height and area of the column being measured, we have the means for exactly measuring the amount of atmospheric pressure.

How is a barometer constructed?—A straight glass tube is taken, 36 inches long, and sealed at one end by the blow-pipe flame. It is then filled with clear, dry mercury (seeing that all the air is removed), its open end being closed by the finger, and immersed in a mercury bath; on removing the finger the mercury will sink from the top of the tube, until it stands 30 inches above that in the bath, and remain at this point, balancing the atmospheric pressure. Other liquids may be used besides mercury, but they are inconvenient. It will be thus seen that the pressure of the atmosphere is capable of sustaining a column of mercury 30 inches in height; such a column, having an area of one inch, weighs between 14 and 15 pounds; hence, such is the pressure exerted upon every square inch of the earth's surface, and objects situated on it, near the level of the sea.

What fact is demonstrated by the above law of the barometer?—That, as we ascend heights, the mercury will fall, owing to the diminution of the length and weight of the superincumbent column of air. By this means the heights of mountains are ascertained, bearing in mind the correction for temperature; and an elevation of 922 feet produces nearly a fall of one inch of the mercury. This is, however, only true near the level of the sea. As we ascend, the pressure diminishes rapidly, for, as we ascend arithmetically, the pressure diminishes geometrically.

What are the variations noticed in the barometer in the same level in some countries?—The regular and horary, and the irregular and accidental. In Europe, it has been observed that the height of the barometer is greatest at two periods in the twenty-four hours, according to the season. In the winter, the first maximum is at 9 A. M.; the first minimum at 3 P. M.; after which the mercury again rises, and attains its greatest elevation at 9 in the evening. In summer, these hours of the ærial tides are altered. The accidental variations are much oftener, and the changes more difficult to note.

HEAT.

What is the distinction made between the terms heat and caloric?—To the sensation produced by a hot body we apply the term *Heat.* To the cause of that sensation, *Caloric.*

Under what two heads is heat considered?—That of sensible, which is marked by the thermometer; and that which is latent, which

is not marked by the thermometer. This latter term has also been called the heat of fluidity.

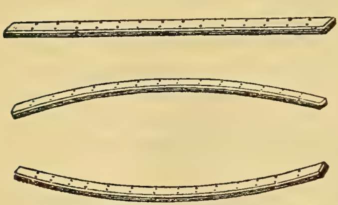
What general law have we in regard to heat, as regards liquids, solids, and gases? — That whenever a solid body becomes liquid, or a liquid becomes gaseous, a quantity of heat disappears, or becomes latent; and whenever a gaseous body becomes liquid or solid, a corresponding degree of caloric is given off. We will consider this subject under four heads: Expansion, conduction or transmission, change of state, and capacity of bodies for heat.

What is meant by the term expansion? — Upon a body being heated, its molecules become repellant to each other, and are removed at a greater distance from each other. It is the reverse of cohesion; and bodies possessing the least cohesive properties are most influenced by heat. Solids are the most cohesive, liquids next, and æriform bodies least.

What are the most expansive of solids? — The metals; but they vary in this property.

Give an example of this variation. — An iron bar being riveted to one of brass, and exposed to heat, so long as the temperature remains unchanged at which the metals were united, the bar remains straight; but any alteration of temperature gives rise to a curvature, and the most expansive, or brass bar, dilates and produces a curvature, with the concave side of the bar in the iron. The converse is also true; if the bar is cooled artificially, the brass bar contracts more than the iron, and we have the brass on the concave side. (Fig. 252.)

Fig. 252.



The observance of this fact of different variations in metals has led to what important invention? — That of the compensating pendulum, in which different metals are used, of different expansive properties; by which means the temperature of the atmosphere produces little or no variation in the measurement of time by the clock. (Fig. 253.)

What was supposed to be an exception to the law of solids expanding by heat? — That of clay, which appeared to contract; but this was easily accounted for, by the loss of water in it.

What is the law in regard to liquids? — Different fluids expand differently, and the same fluid expands differently for equal increments of temperature; as, that the same liquid will expand more from 122° to 212° than from 32° to 122°. Mercury is rather an exception to this rule, as it dilates $\frac{1}{55}$ of its bulk from 32° to 212°; but between 212° and 392°, it expands $\frac{1}{54\cdot25}$. There is no relation between the expansibility and the other properties of solids.

Does the height that the mercury stands in the thermometer in-

dicate its absolute expansion? — No; only the difference between its expansion and that of the glass; but the glass is a corrective for the increasing expansion of mercury above 212°.

Fig. 253.

What instrument has been invented to mark the expansion of mercury, independent of the expansion of the containing vessel?—The apparatus of Dulong and Petit (Fig. 254), consisting of two upright glass tubes, connected at the base by a horizontal smaller tube. Mercury being poured into one tube, ascends to the same height in the other, if the temperature is the same in both tubes. Around these smaller tubes larger ones are placed, by which one of these inner tubes is constantly kept at 32° (0°C), while the other is raised by means of hot water or oil to any temperature. The perpendicular heights of the columns are then read off by a scale attached. These heights represent volumes of equal weight, and because volumes of equal weight bear an inverse proportion to the densities of the liquids, the amount of expansion is easily calculated.

Is not the mercurial thermometer inaccurate when high ranges of temperature are concerned? — Yes, from its increased expansibility; hence, corrections are necessary to be made for it

Fig. 254.

in many experiments, and tables have been drawn up for this pur pose.

What is peculiar in the action of heat upon the bulk of some fluids? — Instead of expanding them, it contracts them at certain temperatures. Water is the most curious example of this, which, when frozen, or ice, floats upon the water by becoming lighter, and the water expanding. The cause of this expansion is attributed to a new arrangement of its particles.

What is a thermometer, and by whom invented? — An instrument for measuring different degrees of sensible heat, by means of the expansion of fluids in tubes, and invented by Sanctorius.

Describe the thermometer of Sanctorius, or the first one constructed? (Fig. 255.) — It consists of a simple glass tube, open at one end and a bulb upon the other. The air in the bulb is expanded by heat, and the open end is plunged into a coloured liquid; by the cooling of the air in the bulb, it is condensed, and the liquid rises in the tube. As the air in the bulb is affected by heat or cold, the height of the liquid will vary, and a measure of temperature be obtained. This instrument is liable to objection, on account of its expansions and contractions being too great to mark any considerable changes in the temperature, and also by its being influenced by meteorological changes or atmospheric pressure.

Fig. 255.

What is the best and most common thermometer now in use? — That in which mercury is used, on account of its equability of expansion, and its boiling and freezing points being so far separated.

How would you construct a mercurial thermometer?— A capillary glass tube of uniform diameter is selected. The one end is closed and expanded into a bulb by the blow-pipe; the other end is slightly drawn out and left open. The bulb is cautiously heated to expel the air, and the open end immersed into mercury, a portion of which rises in the bulb as it cools, replacing the air driven out. The flame is again applied to the bulb, making the mercury boil; the remainder of the air is expelled, and the space filled by the mercurial vapour, which condensing, the metal is forced into the instrument by the pressure of the air, until it becomes completely filled. The thermometer thus filled is now again heated until so much mercury is driven out by the expansion of the remainder, that its level in the tube shall stand, at common temperatures, at the point required. Heat is again applied until the column rises to the top, when you hermetically seal the tube.

What are the mercurial thermometers in use, and how are they graduated? — Fahrenheit's, Centigrade, and Reaumur's. In the first, the scale between the boiling and freezing points is laid off into 180°, and the zero is placed 32° below the freezing point of water, and the boiling point consequently at 212°. In the Centigrade, the scale between the boiling and freezing point is divided into 100 parts; the zero being placed at the freezing point of water. The scale is continued above and below these points, the number below 0 being distinguished by negative signs. In the Reamur instrument, the freezing point of water is made 0°, and the boiling point 80°.

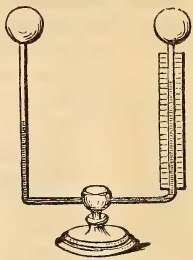
How would you convert Centigrade degrees into Fahrenheit, and the reverse? — Multiply by 9, divide the product by 5, and add 32; and the reverse, subtract 32, multiply by 5, and divide by 9.

In what circumstances do we use alcoholic thermometers? — To estimate very low degrees of temperature.

What is the use of differential thermometers? — They measure

the differences of temperatures between two portions of air, while changes affecting both alike are not indicated. The cut represents Leslie's differential thermometer. (Fig. 256.)

Fig. 256.



To what phenomena does the expansibility of air, by heat, give rise?—To winds. The rays of the sun striking the Equator vertically, and more or less obliquely at the Poles and the temperate latitudes, a difference of temperature is produced. The temperature of the Equator is very warm, and that of the Poles cold. The air at the Equator becomes rarified and rises, forming a partial vacuum; and the cold, heavy condensed air of the Poles, rushes in to fill its place. This produces two currents of wind from the Poles—one blowing north, and the other south, to the Equator.

What is the philosophy of the production of the trade winds?—As the earth moves with the velocity of 1000 miles an hour at the Equator, and diminishes till the Poles are reached, where it is nothing, the wind coming from these points, will have an oblique direction from east to west, because the earth moves from west to east; and at the Equator, where these two currents of air meet, they neutralize each other, and we have calms.

How may heat be communicated?—By conduction, radiation and reflection.

How would you exemplify conduction in solids?—By heating one end of a bar of iron, we find the heat soon communicated to the other, by the approximity of one particle of the bar to the other.

Do all solids convey heat alike?—Metals are the best; and of these, gold is the best, and lead the worst. Porcelain, clay, and glass are very poor conductors.

Are fluids and gases good conductors?—No; heat is communicated by its being placed at the bottom of the vessel containing them, when a current is established by the hotter particles rising from the bottom and descending as they cool. This is termed circulation, or convection.

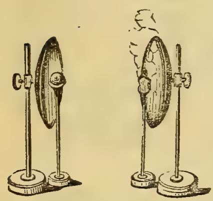
Are not the most porous substances bad conductors?—Yes.

What is meant by the radiation of heat?—The throwing off of heat from a heated body in all directions, and in right lines, like the radii of a circle. The rays of heat pass freely through air, and a vacuum alike, and, when falling on the surface of a body, they may be reflected, transmitted, and absorbed. In the first and second instances, the heat of the bodies is not increased; in the third it is increased. The power of radiation varies according to the surfaces of bodies; rough surfaces giving off more rays than a smooth one. Colour has little or no influence.

What do you mean by reflection, and by what laws is it governed?—When heat strikes a smooth, opaque surface, it is thrown back in a

straight line, and, as in the laws of *Light*, the angle of incidence and reflection are equal. This is proven by the experiment of placing a red-hot body in the focus of a parabolic mirror, with another parabolic mirror placed some distance opposite, and so adjusted that their axes shall be coincident, when a thermometer will soon evince the effect of the heat reflected from the red-hot body; or a piece of a phosphorus may be used. (Fig. 257.) The best radiators are the worst reflectors.

Fig. 257.



To what is the increase of temperature from radiant heat due? — To absorption, which appears to be influenced by colour, as in the experiment of Dr. Franklin, with different coloured pieces of cloth on snow. This, however, according to Melloni, is more dependent upon the nature of the colouring which covers the surface of the cloth.

What natural phenomena are accounted for by these laws of radiation?—The origin of dew, and the land and sea breezes of the tropics, and to a certain degree of the temperate zones. In the case of the dew, when the sun is above the horizon, the heat radiated from the earth, is compensated by the absorption of the solar rays, but when the sun sets, the supply from the sun's rays ceases, while the emission of heat goes on as rapidly as ever, and the surface becomes cooled, till its temperature is lower than the air. The air participates in this reduction of temperature, and the aqueous vapour soon reaches its point of maximum density, when it commences to deposit moisture, dependent upon the amount of vapour in the atmosphere and the extent of the cooling process. Dew is more abundant on a clear, calm night, succeeding a hot day; clouds hinder its formation, by reflecting back to the earth the heat radiated from its surface, and preventing the requisite reduction of temperature. Winds also prevent its formation, by constantly renewing the air lying near the earth, and preventing its reduction of temperature sufficiently to cause condensation of moisture. In the case of land and sea breezes, when the sun shines at once upon the land and sea, the two become unequally heated, the land becoming much the warmer; the air upon the surface of the land becomes expanded by the heat, and rises, and has its place supplied by colder air from the sea, producing the sea breeze. When the sun sets, the surfaces of the land and sea cool by radiation. The cooling of the land is quicker than that of the sea, and the air above becomes cooled and condensed, and flows outward, and displaces the warmer air of the ocean, producing a land breeze.

What is meant by the transmission of heat? — The passage of heated rays through different media.

What is meant by the terms transcalency and diathermacy? — The power possessed by certain solids for transmitting heat; rock salt possesses this in the highest degree.

What do you understand by vaporization, and how is it divided?—

The conversion of a solid or liquid into vapour or gas by heat. It has been divided into ebullition and evaporation.

What occasions ebullition ? — The formation of bubbles of vapour within the liquid, which rise to the surface, and there break; occurring in different liquids, at different temperatures, the point at which it occurs is called the boiling point, which may vary under different circumstances for the same liquid.

What is the relation between the temperature of water and its steam? — They are the same, and the formation of vapour is attended with a loss of sensible heat, so that, no matter how much heat you apply, all above 212° is lost in steam; otherwise, so to speak, water would become red-hot, if its heat did not become latent by evaporization.

Mention the boiling points of some liquids. — Ether 96°, alcohol 177°, water 212°, oil of turpentine 314°, sulphuric acid 620°, whale oil 630°.

Mention the latent caloric points of some vapours. — Water 967°, ether 302°, oil of turpentine 178°, alcohol 442°, &c.

What circumstances modify the boiling point?—The nature of the surface of the vessels; as, in one of glass, evaporating not so readily as in a metallic one, on account of the attraction between the surface of the glass and the water, which prevents a disengagement of its vapour; barometric pressure also has its influence—diminish the pressure and you diminish the boiling point (this principle may be applied to the measuring the heights of mountains, as a depression of 1° equals about 548 feet of elevation); depth of column of liquid; freedom for the escape of vapour, as when steam is not allowed to escape, it goes on exerting increased pressure, its tension being inversely as its bulk

What is the expansion of a cubic inch of water under ordinary atmospheric pressure when becoming steam ? — About a cubic foot.

What is the effect upon steam when in contact with water? — Its elastic force increases in rapid proportion.

Into what two classes may the economical uses of steam be divided? — Into that for heating, and those in which its elastic force is used, as in the steam engine.

What is meant by evaporation ? — When liquids become vapours without the appearance of ebullition or increase of temperature; it occurs at common temperatures. It is much more rapid in liquids of a low boiling point.

What circumstances influence evaporation ? — The nature of the liquids; extent of surface—liquids in shallow vessels evaporating more rapidly than in deep ones; more or less dryness of the air — when the air is in motion evaporation is quicker; temperature—heat aids it; amount of atmospheric pressure—diminished pressure increases it.

What effect is produced by evaporation ? — Cold, by the conversion of sensible into latent heat; this is proven by ether dropped on the hand, and where water contained in a thin glass tube, is surrounded

by a rag and wet with ether is soon frozen; also by an instrument called Wollaston's cryophorous, or frost-carrier.

What is understood by the dew point?—The temperature at which moisture is deposited from air, and it always varies with the temperature and moisture present. Instruments for measuring this are called *hygrometers;* the simplest of which is a silver cup containing water, which is cooled down till moisture is deposited outside, and the temperature is then taken by a thermometer placed in the cup.

What is meant by the term *specific heat?*—That equal quantities of different bodies require unequal amounts of heat to raise them to the same temperature; hence the difference in time which different bodies exhibit when exposed to the same heating and cooling process, simultaneously express their respective capacities for caloric, or their specific heat. To prove this, take 1 lb. of water 162°, and 1 lb. of mercury 100°, which give a mixture of 160°; the mercury has gained 60°, and the water has lost only 2°. Water has then a greater specific heat than mercury, in the proportion of 30 to 1. The specific heat of a body is always diminished by increasing its density.

What is meant by the spheroidal condition of liquids?—The spheroidal shape assumed when liquids are thrown upon a red hot, smooth metallic surface, which, instead of being immediately vaporized, play upon the surface of the metallic plate, and when cooled to 212°, fly off in vapour. This is probably the cause of numerous steam boiler explosions; when water is admitted upon red hot plates, it assumes the spheroidal form, and becomes vaporized by the sudden admission of cold water, when the cooling process to 212° takes place, and an immense amount of steam or vapour is suddenly disengaged.

What are the sources of heat?—The sun, when vertical, by its rays being direct, and the earth a non-conductor, causes intense heat; and the more oblique the sun's rays, the cooler the temperature; the other sources are, combustion, chemical action, mechanical action, electricity, galvanism, and vitality.

LIGHT.

What are the two theories relative to light?—The Newtonian, that it is a material emanation from a luminous body of small particles travelling in straight lines with great velocity; second, the Des Cartes, which is that it depends upon undulations transmitted with inconceivable velocity, through the highly elastic medium of excessive tenuity, filling all space, and occupying the intervals between material substances, which was called *ether.* The latter is the theory generally adopted.

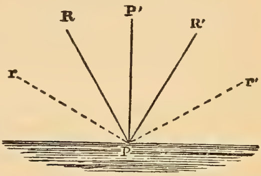
In what direction is light emitted from a luminous body?—In straight lines from every point, like the radii of a circle, and travels at the rate of 200,000 miles in a second.

What becomes of a ray of light falling on a plane surface?—It is either reflected, refracted, or absorbed; the first, when a polished

surface is employed; the second, when the body upon which the light falls, is of the kind called transparent, as glass, or water; the third, when the surface is perfectly black, and destitute of lustre.

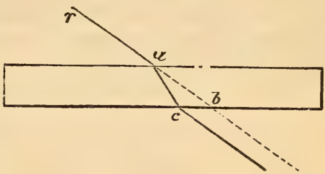
What are the general laws in regard to reflected light?—The rays of incidence and reflection are always in the same plane, which plane is perpendicular to the reflecting surface, and the angle of reflection and that of incidence are always equal (Fig. 258). This rule holds good in regard to curved mirrors. Parallel rays are permanently altered in direction when reflected from curved surfaces, being either divergent or convergent, according to the kind of curvature.

Fig. 258.



What is meant by the term refraction?—As long as light passes through a medium of the same density and chemical character it travels in straight lines, but when this ceases to be the case, the ray of light is bent from its course into a new one, or, is said to be refracted (Fig. 259), excepting when the ray of light is perpendicular to that plane.

Fig. 259.

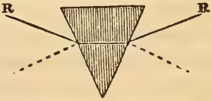


What is the general law relative to refraction?—When a ray passes from a rare to a denser medium, it is refracted *towards* a line perpendicular to the surface of the latter; and, conversely, when it leaves a dense for a rarer, it is refracted *from* a line perpendicular to the surface of the denser substance. In the former case, the angle of incidence is greater than that of refraction, in the latter less.

What substances refract most?—Different bodies refract differently—generally, the denser the most; so, also, combustible bodies, from which Sir Isaac Newton predicted the combustible nature of the diamond.

What is the effect of the transmission of light through curved media?—The same as in case of reflection by curved mirrors. Convex lenses collect the rays, bringing them to a focus, while concave ones disperse them.

Fig. 260.



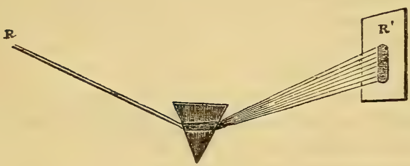
What is the effect when a luminous ray enters a mass of substance differing in refractive power from the air, and whose surfaces are not parallel?—It becomes permanently deflected from its course, and altered in its direction—upon this fact the property of prisms depends (Fig. 260).

Is the light of the sun, the electric spark, and ordinary flames, simple or compound?—Compound.

How is this shown? — If a ray of light be admitted into a dark room, by a small hole in the window-shutter, or otherwise, and allowed to fall upon a prism, it will not only be refracted from its straight course, but will be decomposed into a number of coloured rays, which may be received upon a white screen back of the prism (Fig. 261).

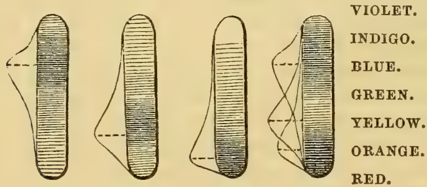
What is the number and colours of the solar spectrum, which this is denominated? — This experiment, made by Sir Isaac Newton, led him to infer that white light was composed of seven primitive colours, viz., violet, indigo, blue, green, yellow, orange, and red, the rays of which are differently refrangible by the same medium, the violet being most so, and the red the least.

Fig. 261.



What is the opinion of Sir D. Brewster in regard to the number of the primary colours? — That there are really three; blue, yellow, and red; and this is now generally the received opinion, borne out by the fact, that when red and yellow are mixed we have orange, and yellow and blue we have green, &c.; each colour extends over the whole spectrum, but has its greatest intensity at one part, as shown by the curve in the diagram (Fig. 262).

Fig. 262.



Upon what are the colours of natural objects supposed to depend? — From the power which the surfaces of bodies have of absorbing some of the coloured rays while they reflect or transmit the remainder; thus, an object appears red, because it absorbs a portion of the yellow and blue rays composing the white light, by which it is illuminated, and reflects the red.

What do you understand by double refraction? — The property possessed by certain crystals of a particular order, when a ray of common light passes them, of dividing it into two rays— one of white is refracted in the ordinary manner; the other takes an extraordinary course according to the position of the crystals. This is seen in the case of a rhomb of Iceland spar, when placed upon a paper having a spot upon it, when the object will be seen double.

What is meant by polarized light?—When a ray of light falls upon a plate of glass at an angle of 56° 45′, the portion of the rays which has been reflected, acquires new properties; for, on throwing it under the same angle upon a second plate of glass, there are two particular positions in which the ray ceases to be reflected. Light polarized by transmission is in an opposite state to that polarized by reflection.

Which parts of the solar spectrum possess the greatest illuminating, heating, and deoxydizing properties?—The greatest illuminating property is between the yellow and green; the greatest heating is in the red space, or beyond it, varying with the kind of prism used; or, if the prism is composed of glass externally and water internally, the yellow is the hottest; the greatest deoxydizing is the violet space, or just beyond it.

What are the chemical effects of light?—Light is necessary to life; chlorine and hydrogen combine under the effects of light; the salts of silver are blackened and decomposed by it; under its influence the leaves of plants decompose the carbonic acid of the air, taking up the carbon and giving off the oxygen, &c.

Does not solar light possess the property of exciting heat?—Yes, when the rays are absorbed; this, however, is influenced by the nature of the surface on which it falls; those substances which absorb radiant heat most powerfully are generally the best absorbers of light; to this rule, however, there are many exceptions. Dark-coloured substances acquire a greater temperature than light-coloured ones; proving that the dark absorb some light as well as heat.

MAGNETISM.

What do you understand by magnetism?—The property possessed by a certain ore of iron, and some other substances, by which small particles of iron are attracted and caused to adhere to its surface. It is called loadstone, or magnetic iron ore.

What do you mean by magnetic polarity?—The points where the attractive force for the particles of iron is greatest, are called *poles*, and the magnetic ore is said to be endued with magnetic polarity.

What is an artificial magnet?—When a bar of iron or steel is rubbed in a particular direction over one of the poles of a natural loadstone, it communicates to the bar its peculiar properties, which has been called an artificial magnet; the attractive force will be greatest at two points near the extremities of the bar.

What occurs when a magnetized iron bar is suspended at its centre, and free to move horizontally?—It assumes a particular direction with regard to the earth; one end pointing nearly north, and the other nearly south. The former of these has been called the north pole and the latter the south pole of the magnet.

What phenomena are presented when the poles of two magnetic bars are brought near each other?—The dissimilar poles, as the north

and south poles, attract each other, while the similar poles, as the north and north, or south and south, repel each other.

What is the effect of placing a piece of iron in the neighbourhood of a magnet? — It acquires more or less magnetic properties, according to the force and distance from the magnet; this is termed magnetism by induction. It disappears when the magnet is removed.

What is the general rule relative to magnetising by induction? — The pole produced is the reverse of the pole producing it, as a north pole induces south polarity, &c.

Is magnetic attraction or repulsion influenced by the interposition of substances destitute of magnetic properties? — No.

Can one kind of polarity be exhibited without the other? — No; a magnetic bar may be broken into several pieces, each piece will still have its own north and south pole.

What are the usual forms of artificial magnets? — That of small needles, with an agate cap in the centre for suspension upon a fine point, also in bars, and curved in the shape of the horse-shoe; all magnets should have armatures or keepers, made of soft iron, attached to their extremities to prevent the loss of magnetism.

What is understood by the *dip* of the needle?—If a magnetic bar is suspended upon an horizontal axis, passing through its centre of gravity, it will take a permanent position, the north pole being downwards, and the magnet making an angle of about 70°, with an horizontal plane passing through the axis. This is termed the *dip*, or inclination of the needle, and shows the direction in which the force of terrestial magnetism is most strongly exerted. This dip differs in different latitudes; near the Equator it is very small.

Is not the earth a great magnet?—Yes.

What is meant by the *declination* of the needle?—The magnetic meridian of a place not being usually coincident with its geographical one, but makes with the latter a certain angle, which has been called as above. The amount of this declination varies not only at different places, but at the same place, daily, yearly, and secularly, which are termed the variations of declination. In our latitude the north pole points 24° west of the meridian.

What is the mariner's compass? — A magnetic needle suspended over a circular card, marked with the points. It was introduced into Europe in 1300, but was long before known to the Chinese.

What discoveries have been made by Faraday relative to magnetism? — That it is not peculiar to such substances ordinarily called magnetic, as iron, nickel, cobalt, &c., but that it is the property of all matter.

What is the origin of the terms magnetic or paramagnetic, and diamagnetic? — Mr. Faraday perceiving that the magnetic action on different substances capable of being easily moved. differs not only according to the size, but also according to the substance, the former

being attracted by both poles of the horse-shoe magnet, the latter being repelled; he divided them into these two classes.

Mention some of the substances which belong to the paramagnetic, or first class. — Iron, nickel, cobalt, manganese, chromium, cerium, titanium, palladium, &c.; and recently oxygen has been discovered.

Mention some of the substances of the second class, or diamagnetic. — Bismuth, antimony, zinc, tin, cadmium, sodium, mercury, lead, silver, copper, gold, arsenic, uranium, rhodium, iridium, tungsten, phosphorus, iodine, sulphur, chlorine, hydrogen, and many of their compounds. Also, glass free from iron, water, alcohol, ether, nitric acid, hydrochloric acid, resin, wax, olive oil, oil of turpentine, caoutchouc, sugar, starch, gum, and wood.

When these two classes are combined, what effect is produced? — Their peculiar properties are destroyed.

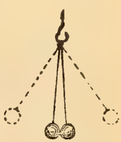
ELECTRICITY.

When was this discovered, and from what cause so named?—About 600 years B. C.; the ancients discovered the remarkable property in amber of being excited by friction, to which moderns have given the name electricity, from the Greek name for amber, ηλεκτρον.

How may electrical excitement be produced?—By rubbing amber, sealing-wax, glass, and sulphur, and holding them near light bodies, as pith-balls, or gold-leaf, and they attract them. The bodies rubbed are said to be electrified; and if the bodies rubbed be suspended, they will approach contiguous bodies.

What is the basis of electrical science?—The fact that light bodies, as pith-balls, (Fig. 263,) being suspeneded by a delicate silk thread or wire, will at first be strongly attracted to an electrified glass tube, but in an instant will fly off from it; and any further effort to attract them by the tube will only cause their greater repulsion from each other, or the tube. If, instead of glass, we use a stick of sealing-wax electrified by rubbing with flannel, and present this to the pith-balls, which have been excited by the glass, a strong attraction will be seen to be manifested between them. The first of these has been called *vitreous*, or positive; and the latter *resinous*, or negative electricity.

Fig. 263.



What is the general law in regard to electrified bodies?—Similarly electrified bodies repel each other, and dissimilarly electrified bodies attract each other.

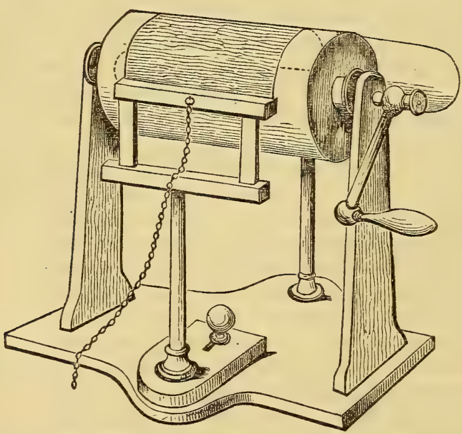
What are the two theories relative to electricity? — The Franklinian, which supposes only one kind of electricity, which pervades all matter, uniformly distributed, but which may be disturbed by excitation from various causes; and that, when there is over electricity in one substance, there is less in the other. The former is termed posi-

tive (or vitreous of Du Fay); the latter negative (corresponding to the resinous of Du Fay), and these states repel each other. The second theory treated of by Du Fay, supposes two kinds of electricity or distinct fluids, and that these were accumulated on all unexcited substances, in a state of combination and neutralization, and that friction separates these; and that one is vitreous, and the other resinous.

What do you mean by electrics or non-conductors, and non-electrics, or conductors?—All bodies that indicate electric excitation, are called electrics, and the reverse, non-electrics.

What are the elements of an electrical machine? — The non-conductor, or glass cylinder or plate, covered with silk, and revolving on its axis, in contact with the rubber or cushion, covered with an amalgam of mercury, tin, and zinc, and the prime conductor, or metallic cylinder, armed with points to convey away the electricity as developed. This, and all other parts of the instrument should be *insulated* by glass rods, to prevent the electricity being taken off by the earth. (Figs. 264, 265.) When a maximum effect of electricity is desired

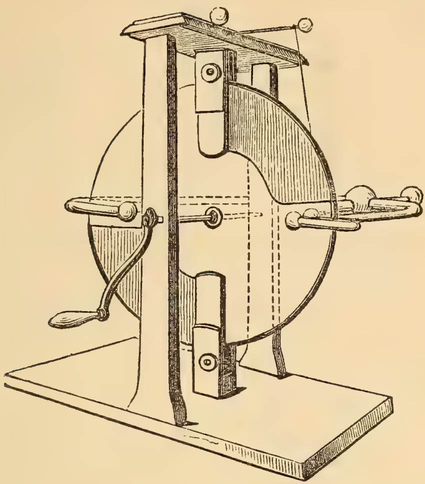
Fig. 264.



to be produced, the rubber should communicate with the earth by a chain of metal. If negative electricity is desired, the conductor should communicate with the earth, the rubber be insulated, and the electricity be drawn from the rubber.

What are electrometers, or electroscopes? — Instruments for measuring electrical intensity. They are of various forms. The best is that of two gold leaves suspended in a glass bell-jar, and connected by a wire with a metallic cap above. The approach to this plate of any excited body will cause a movement in the leaves. The names of the

Fig. 265.

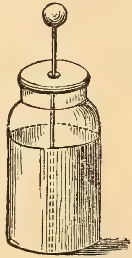


other forms are the quadrant, Colomb's torsian, and the balance electrometers.

How is electricity distributed upon an excited body? — Upon the surface.

What is the Leyden jar, and what is its use?—It was invented by Cunæus, of Leyden, in 1746. It is simply a glass jar (Fig. 266) with a wide mouth, covered inside and out with tin foil nearly to the top, and corked with dry wood, which is perforated with a brass rod and chain, the outer end of which terminates in a brass ball, and the inner with the interior coating of the jar. When the ball is held near the conductor of an electrical machine in action, a series of vivid sparks is received by it, and accumulation of vitreous electricity takes place interiorly, if the exterior is not insulated. When a connection between the exterior and interior is established by a conductor, the equilibrium is restored, accompanied by a brilliant flash. If the hand of the operator is the conductor, a shock is felt. It is used for the accumulation of electricity.

Fig. 266.



What is an electric battery? — A series of jars so arranged as to be charged by one machine, when all the inside coatings unite, and the outsides are also connected.

Will not a jet of high steam issuing from an insulated steam boiler, with proper precautions, give a stream of powerful electrical sparks?—

Yes; this is owing to the friction of the steam against the edges of the orifice, and is called hydro-electricity.

GALVANISM, OR VOLTAIC ELECTRICITY.

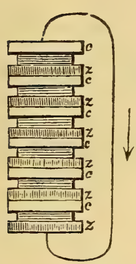
By whom was galvanism discovered, and by what accident? — By Galvani, in 1790. He observed that, when the sciatic or crural nerves of a frog were touched by a metallic conductor, in contact with an electrical machine in action, convulsive movements took place in the limbs of the frog, from which he inferred that muscular movements were caused by electricity.

What was the theory of Volta, relative to this? — That the contact of the two metals generated the electricity, and the frog's legs were only an electroscope.

What is the instrument called the Voltaic pile? — A series of copper and silver coins, with pieces of cloth, wet with acid or saline solutions, between them; and, on establishing a communication between the poles by a wire, a current of electricity flows between them. (Fig. 267.)

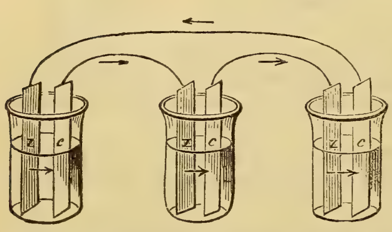
What is the difference between galvanism and electricity? — They are identical. In the former, however, there is a larger quantity developed, but without much tension, and produces its effect while flowing along conductors. In the latter, being insulated, it has great intensity, but is small in quantity.

Fig. 267.



What are voltaic circles? — When a plate of zinc and one of copper are made to touch each other, we have electricity excited by the contact, but too small in quantity to influence an electroscope; but when the plates are placed in dilute sulphuric acid, and their edges brought in connection immediately, or by a wire, a current of electricity is set up, and hydrogen gas will be evolved at the copper plate, and the zinc will be oxydized. The zinc, being most affected, becomes positive, and the copper negative. We have an arrangement similar to this in the voltaic pile, described before; and in the crown of cups (Fig. 268), where we have a series of cups, containing dilute sulphuric acid, each cup has in it a piece of copper and zinc. The copper of the first cup is connected with the zinc of the second; and the copper of the second with the zinc of the third, &c. Upon establishing a connection between the first and last plates, a discharge takes place.

Fig. 268.

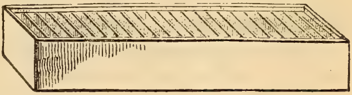


If we have merely a single pair of conductors and an interposed liquid, it is called a *simple circuit.* When two or more alternations are concerned, the term *compound circuit* is applied. Numerous Voltaic circuits connected are termed *Voltaic* or *Galvanic Batteries.*

What is the plain explanation of the direction of the currents?—The current of every battery in action starts from the metal attacked, passes through the liquid to the second metal, or conducting body, and returns by the wire or other channel of communication; hence, in the *pile* and *crown* just described, the current in the battery is always from the zinc to the copper, and out of the battery from the copper to the zinc, as shown by the arrows. See figure 268.

What is the Cruikshank battery?—The zinc and copper plates are soldered together, and cemented water-tight into a mahogany trough, (Fig. 269) which is thus divided into a series of cells capable of receiving the exciting liquid. This apparatus is fitted to exhibit efects of *tension*, and give *shocks.*

Fig. 269.



Upon what does *quantity* and *tension* in the circuit depend?—The quantity depends upon the surface, and the tension upon the number of plates, and that the plates should not be too far apart.

How is the energy of a voltaic current measured?—By the deflection of the magnetic needle from its meridian, assuming a position east and west, and is capable of measuring the energy and direction.

What is meant by *constant* batteries?—Those in which we have a voltaic circuit of equal power constantly. It was found that, by constant use, common zinc and copper loose their efficiency; for this purpose platinum, plumbago, charcoal, and other substances have been used to make them constant. One of the best, however, is the following (Grove's), which may consist of a number of cells, composed of a glass vessel, holding a zinc cylinder, within which is a porous porcelain cylinder, but not large enough to fill the cavity of the zinc, and within the porcelain one, a slip of platinum is placed. A solution of sulphuric acid is placed between the zinc and porcelain, and nitric acid poured into the porcelain one, surrounding the platinum, when the circle is closed by the junction of the wires, one of which is attached to the platinum, and the other to the zinc, a current takes place from the zinc to the platinum. A sulphate of zinc is formed which is prevented from depositing by means of the porcelain. Again, as hydrogen may collect in bubbles on the other plate, this is prevented by the nitric acid in the porcelain cup, which, by the decomposition of the nitric acid, and yielding up of oxygen, prevents such an occurrence by the oxygen uniting with the hydrogen and re-forming water. We have other batteries by Snell, Daniels, and Bunsen. The latter, the carbon battery, is very efficient.

Which is now the accepted theory relative to the nature and cause of galvanism? — *Chemical action.*

Have not electrical phenomena been discovered in certain fishes?— Yes; in the torpedo, or electric ray, and the electric eel, of South America.

What do you understand by electrolization? — The decomposition or chemical analysis by means of the battery, in which two conditions are necessary. 1st. That the substance to be decomposed must be a conductor, and 2d. It must be in a liquid state. The thing decomposed, is termed an electrolyte.

What is meant by poles, or electrodes of the battery? — The points at which the evolution of each constituent takes place. Mr. Faraday called the plate from which the current sets out in the liquid, the *anode*, (corresponding to the positive pole,) and the other, the *cathode*, (corresponding to the negative pole.)

Who first made known the law of electro-magnetic attraction and repulsion?—Prof. Oersted, 1819, and they were afterwards developed by M. Ampere.

What is the effect of an electrical current upon a magnetized needle? — The poles, or centres of magnetic force, are neither attracted nor repelled by the wire carrying the current, but made to move *around* the latter by a force which may be termed tangential, and which is exerted in a direction perpendicular to the current, and tc the line joining the pole and the wire; both poles of the magnet being acted upon at the same time, and in contrary directions, the needle is forced to arrange itself across the current; so that its axis may be perpendicular to the wire. This occurs always when the influence of terrestrial magnetism is removed. The action also between the pole and wire is neutral, as is shown by rendering the wire movable, and placing a magnet in its vicinity.

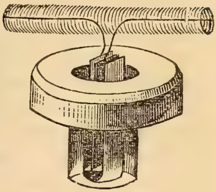
What is Ampere's theory of the phenomena of terrestrial magnetism?—That a series of electrical currents circulates about the earth, from west to east, in spirals, nearly in right angles to its magnetic axis, which led him to the inference that if a voltaic current passed in a spiral about any conductor, it would become magnetic.

How did he verify this? — By the helix. When a coiled wire is made the medium of communication of a voltaic current, it becomes capable of communicating very strong magnetic influence upon any conductor placed in its axis. If a steel needle is used, the magnetism will be retained; but if soft iron, it is magnetic only while the current is passing. The polarity of the needle, in the helix, will depend on the direction in which the current is carried; if from right to left, the south pole being at the zinc end, and the reverse; and if the spiral is reversed in the middle, then a pair of poles will be found at the point of reversal.

By what instrument is the polarity of the helix shown? — By De la Rive's ring (Fig. 270); a small wire helix, whose ends are attached

to the little battery of zinc and copper, in a glass tube fitted into a cork collar, by which it floats on water, when the small battery is excited by dilute acid thrown into the tube; while the whole floats on water, it will assume a polar direction, as if it were a compass-needle, and exhibit the same phenomena.

Fig. 270.



What effect is produced upon soft iron by the induction of magnetism by voltaic currents?—It furnishes the means of producing magnets of astonishing power.

Who first demonstrated the fact that the power of an electro-magnet, with a given voltaic current, was greatly increased when the helix wire was divided into coils of limited length, and the corresponding ends of the helices go to their appropriate poles?—Prof. Henry.

Cannot the attracting and repelling powers of the magnet be applied to rotary motion?—Yes; all that is required is to have the two extremities of a horse-shoe magnet wrapped with a helix, and having this latter piece arranged to rotate upon a point contiguous to a bar of soft iron; by conveying a current of electricity through the helix around the bar, we confer on it polarity, and its south pole will be attracted by the north pole of the magnet; now, if we interrupt the current by pieces of wood, so that the current is reversed at each semi-rotation, we get a continued and rapid motion.

Cannot magnetism produce electric currents?—Yes; this is proven by using a compound horse-shoe magnet with a large bar of soft iron, wrapped with a helix, placed within its poles; when this latter is made to revolve rapidly, a current of magnetic electricity is evolved, which will produce a shock, &c.

Is not the earth supposed to be a huge magnet?—Yes, with voltaic circles surrounding it at right angles to its axis from east to west, and its pole corresponding to its geographical ones, and because opposite poles attract, the north pole of a magnet should really be considered its south pole, and vice versâ; hence the poles of the magnet are often called the *marked* and *unmarked* poles.

May not electricity be developed by heat?—Yes; this has been called thermo-electricity; the conditions necessary are, that we have two conductors, one better than the other, and heat applied at their point of union.

What is one of the most useful applications of electro-magnetism?—The magnetic telegraph; the one most used is that by Prof. Morse.

How do Aldini and Matteucci prove the existence of electricity in the animal body?—By holding the lumbar nerves of a frog in one hand perpendicular, and touching the tongue of an ox, lately killed, and at the same instant the operator grasps the ear of the ox with the other hand, well moistened in salt and water; a convulsion ensues in the legs of the frog, showing the passage of an electric current.

INORGANIC CHEMISTRY.

What is meant by the specific gravity and density of a body? — These terms are frequently used synonymously; but sp. gr. denotes particularly the weight of a body as compared with the weight of an equal bulk or volume of the standard body which is reckoned as unity. While *density* denotes the mass or quantity of matter, compared with the mass or quantity of matter of an equal volume of some standard body arbitrarily chosen.—[*Fowne's Chem.*]

What weight is taken as the unit or standard in computing the specific gravity or comparative weights of solids and liquids? — That of water.

What weight is taken as the unit in determining the specific gravity of gases? — That of atmospheric air.

Upon what does the difference in the specific gravities of different bodies depend? — Upon the difference in their densities, or degree of compactness.

How do we find the specific gravity of a solid? — The body is first weighed in air, and then suspended in water, by means of a hair, and weighed again; and the weight of the body, when in the air, is divided by the difference between the two weights thus obtained.

What is the *rationale* of this process? — Since a solid, when immersed in water, will displace an equal bulk of that liquid, the difference in the weights represents the weight of the equivalent bulk of water which is displaced.

How do we ascertain the specific gravity of a liquid?—By dividing the resistance encountered by a body in sinking in that liquid, by the difference it encounters in sinking in water.

How is this explained?—By the fact that the same body displaces equal bulks of different liquids.

What instruments are generally used to ascertain the specific gravity of liquids? — Hydrometers.

What is the particular one most employed? — That of Baumé; in which the degree of resistance is determined by the depth to which the instrument sinks in the liquid, which is marked by a graduated scale.

How many of these are employed?—Two; one (for liquids heavier than water), in which the specific gravity of distilled water is assumed as the zero of the scale, which is graduated from above downwards, and one (for the liquids lighter than water), in which the specific gravity of distilled water is assumed as 10° on the scale, which is graduated from below upwards.

What else is necessary? — A table showing the specific gravities corresponding to the several degrees of the hydrometer. (See the *United States Dispensatory, Appendix*, p. vi.)

How may we obtain the specific gravity of a gas? — By filling a glass globe with air and weighing it, and afterwards weighing the

same vessel filled with the gas in question, and then dividing the weight of the atmosphere by that of the gas; or the weight of the gas may be ascertained by means of a barometer.

What is meant by attraction ? — The tendency evinced by bodies or particles to unite with other bodies or particles.

How is the attraction of particles divided ? — Into homogeneous attraction, or that which unites particles of the same nature; and heterogeneous attraction, or that which causes particles of different kinds to enter into combination.

What other names have been applied to homogeneous attraction ?— Cohesion, and attraction of aggregation.

What other names have been given to heterogeneous attraction ? — Chemical attraction, or affinity.

What effect has heat upon cohesion ? — It diminishes its intensity; causing bodies to expand, and to melt or assume a liquid form, and sometimes to evaporate, or assume the form of vapour or gas.

Is it possible entirely to overcome cohesion by mechanical division ? — It is not.

By what other means may cohesion be partially overcome ? — By solution.

How may the influence of cohesion in counteracting affinity, or chemical attraction, be shown ?—By the fact that nitric acid will produce no visible reaction upon a solid piece of brass; whereas, if the brass be reduced to the form of powder or filings, a violent reaction and union takes place immediately.

When cohesion or the attraction of aggregation is allowed to take place under favourable circumstances, what occurs ? — The particles advance themselves together in regular shapes or crystals.

By what methods may crystals be formed artificially ? — By fusion, followed by gradual solidification; by solution, followed by precipitation; and by sublimation.

What is meant by fusion ?—The conversion of a solid into a liquid by means of heat.

What is meant by precipitation ? — The act of throwing down or depositing a solid from a solution.

What is sublimation ? — The act of converting a solid into vapour, and afterwards condensing or restoring it to the solid state.

To what do crystals owe their transparency ? — To the water contained in them, called water of crystallization.

Does water of crystallization exist in all crystals ? — It does not; being absent from such as are opaque.

What is meant by deliquescence and efflorescence ?—When a crystal absorbs moisture and becomes liquid, it is said to deliquesce; when a crystal gives up its water of crystallization and is converted into a powder, it is said to effloresce.

What name is given to the union of two or more substances by chemical attraction or affinity ? — It is called a chemical compound.

What characterizes chemical compounds?—They differ in many of their properties from either of their constituent elements, and sometimes possess properties directly opposite to those of their elements when uncombined.

What are some of the changes undergone by bodies entering into chemical combinations? — Changes of size, density, form or consistence, temperature and colour.

What is meant by simple combination?—The union of two heterogeneous substances to form a compound. (Thus copper and zinc unite to form brass.)

How may single elective attraction, or simple affinity, be shown? — It is shown when two substances are in chemical combination, and a third is added which combines with one of the substances to the exclusion of the other. (As when potassa being added to a solution of sulphate of magnesia, or Epsom salts, the potassa unites with the sulphuric acid to form sulphate of potassa, while the magnesia is precipitated, or falls to the bottom of the solution.)

What is said to happen with regard to the original compound? — It is said to be decomposed.

To what is this decomposition attributed? — To the affinity which exists between elements of the new compound, being greater than what existed between the constituents of the former compound.

What is meant by double elective attraction, or complex affinity? — A case in which the compounds mutually decompose each other and form new combinations, as when sulphate of zinc and acetate of lead are mixed in solution, the sulphuric acid unites with the lead to form sulphate of lead, and the acetic acid unites with the zinc to form acetate of zinc.

What other case of affinity may take place? — When two substances are in combination, a third being added in excess, combines with both. (As when ammonia, being added to a solution of nitrate of copper, at first combines with the acid and precipitates the oxide of copper, but more ammonia being added combines with the copper, forming a soluble compound, which is again taken up in the solution; the whole forming the ammoniacal nitrate of copper.)

What condition facilitates chemical reaction? — A state of liquidity, or solution, without which many substances will not react upon each other.

What other causes promote chemical reaction? — Heat, percussion, pressure, &c.

What characterizes the combination of bodies which have a strong affinity for each other? — They unite in fewer proportions, and are more insoluble than those bodies which have a feeble affinity for each other.

How does a mixture differ from a solution? — In the former case there is merely a mechanical intermingling of particles of the sub-

stance to be dissolved, and those of the liquid; in the latter, a chemical union takes place between them.

What is meant by saturation? — That point at which the liquid used as a solvent, or menstruum, refuses to take up any more of the substance to be dissolved.

What is meant by the theory of definite proportions?—That bodies unite to form new compounds in proportions that are invariable for the same compound; as, for instance, water is invariably found to be composed of eight parts of oxygen by weight, to one of hydrogen.

What is meant by the term chemical equivalents? — Numbers which represent the least proportion in which any substance will combine with another. (Thus, the equivalent of hydrogen being 1, that of oxygen is 8, representing the least ratio or proportion in which either of those substances will combine with any other.)

Do the numbers, or equivalents, represent absolute weights? — They do not; but merely the relative weights in which the bodies combine.

What is the rule with regard to the progressive proportions? — When two bodies unite in different proportions to form more than one compound, the proportions in which they unite, are multiples of the least combining proportion of each body. Thus, one proportion of sulphur (whose equivalent or relative weight is 16), combines with two proportions of oxygen, (the relative weight or equivalent of each proportion being eight,) to form sulphurous acid; or one proportion of sulphur equivalent $= 16$) combines with three proportions of oxygen ($8 + 3$) to form sulphuric acid; the proportions being multiples of the least combining proportion of each substance.

How are the equivalents of the compounds determined?—By adding together the equivalents entering into the combination. (Thus, the equivalent of sulphuric acid may be found by adding the equivalents of one proportion of sulphur $= 16$, to the equivalents of three proportions of oxygen $= 8 \times 3 = 24, = 24 + 16 = 40$; — thus the equivalent of sulphuric acid is 40.)

Upon what has the ratio of the equivalent numbers been supposed to depend? — Upon the weights of the atoms, or particles of the substances to which they belong; hence the equivalents are sometimes known by the name of atomic weights.

What is understood by the theory of volumes? — The equivalent bulks, or proportions by size, in which gases combine with each other.

What rule do gases observe in combining with each other? — The rule of definite and multiple proportions as regards bulk.

Are the combining volumes of different gases of the same size? — Many of them agree in the size of their volumes, as hydrogen, chlorine, nitrogen, carbon, and cyanogen; but oxygen, though eight times as heavy as hydrogen, has a volume only half its size, and ammonia

has a volume twice as large as that of hydrogen, and four times as large as that of oxygen. (Thus sulphuric acid, composed of sulphur and oxygen, unites with oxide of copper as a base, which is composed of copper and oxygen, to form a salt called sulphate of copper; the oxygen being common to, or contained by both.)

How are simple inorganic bodies divided by Berzelius?—Into halogen bodies, or generators of salts; amphigen bodies, or such as unite to form either acids or bases; and radicals, or such as unite with other bodies to form acids or bases, but do not form acids or bases with each other.

What is understood by *salts*?—A compound formed by the union of two binary compounds, standing to each other as electro-positive and electro-negative, or as base and acid. The bases result always from the union of a metal and metalloid. The acids are usually derived from the union of two metalloids. The salts of the metallic acids are, however, an exception, as the metal is present alike in both.

Are not salts formed *only* between members of the same class?—Yes; oxygen acids unite only with oxygen bases, &c. Compounds belonging to *different series* either do not unite at all, or they mutually decompose each other.

What is meant by a neutral salt?—When there are as many equivalents of acid engaged as there of oxygen in the base. This is true also of those acids which contain no oxygen.

What important compounds are there which possess in a high degree the properties to which the general definition of salt will best apply?—The binary compounds of chlorine, iodine, &c. To avoid this difficulty, two classes of salts have been instituted. The first called haloid, which includes all binary compounds which have a metallic base in direct union with a *salt radical.* The second, oxysalts, which are supposed to be constituted of the oxyde of the metal and of an oxygen acid.

What is included in the term salt radical?—All members of the oxygen group, except oxygen and those compound bodies which act the part of elements.

Into what two divisions have salts been divided by chemists generally?—Into amphigen salts, or those formed from amphigen bodies (as oxygen, sulphur, &c.); and halogen, or those containing a halogen body (as chlorine, bromine, &c.).

What is a double salt?—One in which the same acid is united with two different bases.

What are the characteristics of salts?—They are solid at ordinary temperatures, generally capable of crystallization, of a variety of colours; some attract water easily from the air, and deliquesce; have different degrees of solubility in water, according to their greater or less affinity for it. Generally each salt has its own specific crystalline form.

How may crystallization be produced?—By fusion and cooling,

and solution and evaporation; or by the passage of a substance from the gaseous to the solid state.

What relation does water bear to many salts in crystallizing? — In some, water is chemically united with the crystal, and is termed water of crystallization, which when driven off by heat, undergoes *watery fusion.* On exposure to the air, such salts part with a portion of their water of crystallization, and effloresce. Other salts have their water more intimately connected, which is called constitutional water. Some enclose a portion of water mechanically, which, when heated, expands and decrepitates, or bursts with a crackling noise.

Does not atmospheric pressure have an effect upon crystallization? — Yes.

How are crystals divided? — Into simple and compound.

What is meant by cleavage? — The tendency possessed by crystals of being *cleft* in certain directions.

What is meant by isomorphous and dimorphous? — The former is applied to bodies having the same crystalline structure, but different chemical composition; the latter, where the same substance may have, under different circumstances, two crystalline forms, as carbonate of lime in calcareous spar and arragonite.

What is meant by the term allatropy, as applied by Berzelius? — A variation of properties observable in a solid which is not crystalline, or where the crystalline form is indeterminate. Diamorphism is a particular instance of allatropy.

How are the angles of crystals measured? — By instruments called goniometers (Figs. 271, 272.)

What is meant by the term isomeric bodies? — Bodies which are

Fig. 271.

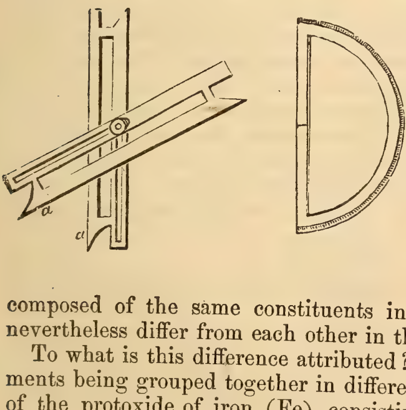
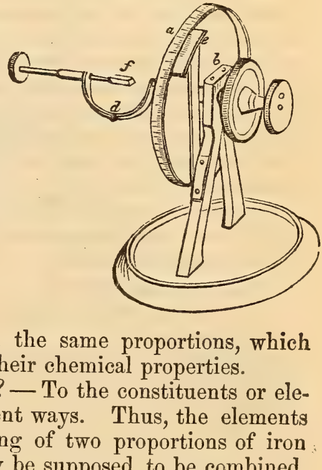


Fig. 272.



composed of the same constituents in the same proportions, which nevertheless differ from each other in their chemical properties.

To what is this difference attributed? — To the constituents or elements being grouped together in different ways. Thus, the elements of the protoxide of iron (Fe), consisting of two proportions of iron (2 Fe), and three of oxygen (3 O), may be supposed to be combined,

either according to the formula, Fe^2O^3, or according to another formula, $Fe\ O + Fe\ O^3$; these formulæ expressing combinations which are isomeric, that is, equal in their proportions, yet combined in different ways.

What is now understood by isomerism? — The identity of composition of two or more bodies, as expressed in the proportion of their constituents in 100 parts.

How many simple elementary bodies have been discovered?—Sixty-five.

CHEMICAL NOMENCLATURE.

What is the general basis for chemical nomenclature, as now generally adopted?—In the infancy of chemistry, arbitrary names were used; but upon the knowledge of a greater number of substances, this plan was varied, and the following, with slight emendations, has been adopted. Arbitrary names are still applied, generally referring to some marked peculiarity of body. Uniformity in the termination of the word is generally observed, as in the case of new metals, whose names are made to end in *ium*.

Upon what principle are the compounds formed by the union of non-metallic elements with metals, or with other non-metallic elements? — They are collected into groups, having a kind of generic name derived from the non-metallic element, or that most opposed in characters to a metal, and made to terminate in *ide*, as oxides, chlorides, &c.; of hydrogen, and of the several metals.

What name is given to compounds formed by direct union of oxygen with other bodies? — Oxides; which have been divided into three principal groups.

Describe these groups? — The first of these contains all oxides, resembling in their chemical relations, potassa or soda, &c., and are called alkaline or basic oxides, or salifiable bases; the second group is composed of those having properties exactly opposed to the first, as oil of vitriol, &c., and are called acids, and tend strongly to unite with the basic oxides; the third group is termed neutral oxides, from their little disposition to enter into combination. When bodies unite with oxygen in several proportions, especially when the oxides of the metals are concerned, we distinguish the one with the strongest marked basic character, as the *protoxide*, and those next succeeding, *binoxide* or *deutoxide*, &c.; when there is a compound between a proto and binoxide, we term it *sesquioxide*. The highest oxide, without distinctly acid characters, is called *peroxide;* any compound containing less oxygen than the protoxide, is called *suboxide*.

To which of these groups do we give the name in practice, of *acid?* — The second.

May not the same element, in combining with oxygen in more than one proportion, yield more than one acid? — Yes; in such cases to the acid containing most oxygen we give the termination *ic*, and the one with the lesser quantity, *ous;* as more became known, the prefix *hypc* or *hyper* was added, &c.

Upon what does the nomenclature of salts depend? — Upon the name of the acid they contain; when the name of the acid terminates in *ic*, that of the salt terminates in *ate*, if in *ous*, the salt terminates in *ite*, &c., and if two equivalents of the acid are present, we call it *bi*, and if two of the base *di*.

How do we distinguish compound bodies? — By analogy; in the case of the non acid compounds (for example) of chlorine, iodine, &c., we call them chlorides, iodides, &c., when the compound is inflammable, the termination of *uret* is used, as carburet, &c.

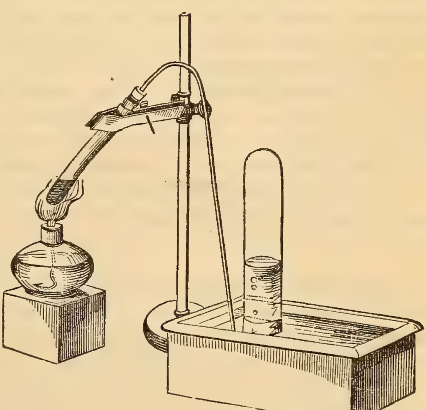
How are simple substances and their combinations frequently expressed? — The simple substances are denoted by letters or symbols, and their combinations are expressed by grouping together the symbols of the constituents into what are called chemical formulæ; the proportion of each of the constituents, when it consists of more than one, being expressed by an arithmetical figure attached to its symbol. (Thus, oxygen is represented by O; hydrogen, by H; water, which is composed of one proportion of oxygen to one of hydrogen, is expressed by the formula H O; the symbol of tin being Sn, the sesquioxide of tin, which contains 2 proportions of tin (2 Sn) to 3 of oxygen (3 O), is expressed by the formula $Sn^2\ O.^3$; or, sometimes by abbreviations, as when two equivalents of a substance are indicated by the symbol, with a short line drawn through, or below it. A number placed before a compound, multiplies all that follows it, &c.

SIMPLE NON-METALLIC BODIES.

OXYGEN.

Where is oxygen found in nature?—In atmospheric air, in water, and in almost every important compound which exists in nature.

Fig. 273.



From what is the name oxygen derived? — From a combination of two Greek words signifying *to generate acids;* from the belief that long prevailed of its being the only acidifying principle.

How may oxygen be obtained? (Fig. 273.) — By subjecting the peroxides of manganese, of lead, or of mercury, or the chlorate or nitrate of potassa to heat, which causes them to give up a

portion of their oxygen; or by heating equal weights of peroxides of manganese, and concentrated sulphuric acid together in a retort.

What is the *rationale* of the last process?—The peroxide gives up one proportion of its oxygen, and is thus converted into a protoxide, with which the sulphuric acid combines, forming a salt called sulphate of manganese.

What is a retort?—A chemical implement, made of iron, porcelain, or glass, generally in the shape of a flask, with a tapering neck bent upon itself at somewhat less than a right angle with its body; and a tubulated retort is one having a mouth and stopper, for the convenience of introducing the materials to be subjected to chemical action.

How is the gas thus generated collected?—By means of a pneumatic trough, which consists of a tub or trough containing water, having a shelf perforated with holes, beneath the surface of the water; the bell-glass or receiver destined to receive the oxygen should be filled with water and placed upon the shelf, with its opening over the perforations in the shelf; the beak, or smaller extremity of the retort is then plunged under the shelf; and the gas, generated by the application of heat to the body of the retort, or by other means, escapes from the retort, and ascends through the water into the bell-glass or receiver, displacing the water contained in it.

What are the properties of oxygen?—It is a colourless gas, insipid, and inodorous, heavier than atmospheric air (its specific gravity, taking atmospheric air as the unit, being 1.1024), slightly absorbed by water, absolutely necessary to respiration, an active supporter of combustion, but a non-conductor of electricity.

What is to be understood by its being a supporter of combustion?—When existing in a state sufficiently pure it combines rapidly with other bodies, giving rise, at the same time, to light and heat.

How may this be illustrated?—By igniting a piece of spunk fastened to the end of an iron wire, and plunging the wire with the burning spunk into a vessel of oxygen gas, when the iron will take fire and be consumed.

What would take place if the atmospheric air were composed of pure oxygen?—It would be impossible to put a stop to combustion, and a universal conflagration would take place.

How is oxygen usually denoted in writing?—By the symbol O.

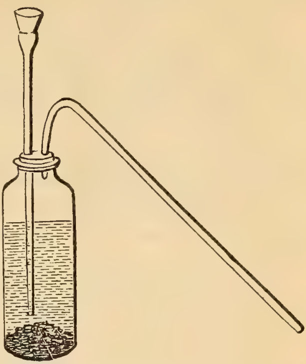
What is the chemical equivalent of oxygen, and combining volume?—8, and combining volume 50.

HYDROGEN.

How does hydrogen exist in nature?—It exists in combination with oxygen in the form of water, whence its name, which is derived from two Greek words, υδωρ and γεννaω, signifying to *produce water.*

What other names had it formerly?—Inflammable air, from its combustibility; and phlogiston, because it is the principal constituent in all ordinary flame, and was thence supposed to be the matter of heat.

Fig. 274.



How is it obtained in a separate state? (Fig. 274) — It may be obtained in the purest state by the action of dilute sulphuric acid upon pure distilled zinc, or by the decomposition of water by the galvanic battery; but it is usually obtained by the action of dilute sulphuric acid upon iron filings; or by passing steam through a gun-barrel filled with iron turnings, or wire heated to a red heat.

What is the *rationale* of the evolution of hydrogen by the action of dilute sulphuric acid upon iron wire, or turnings, or upon zinc? — The water is decomposed; its oxygen uniting with the metal to form an oxide, with which the sulphuric acid unites to form a sulphate, while the hydrogen escapes, or thus —

Water	Hydrogen	Free.	
	Oxygen		
Zinc		oxide of zinc	Sulphate of oxide of zinc.
Sulphuric acid			

What is the *rationale* of the evolution of hydrogen by the action of heated iron filings upon steam? — The steam is decomposed, the oxygen uniting with the iron, while the hydrogen escapes.

What are the properties of hydrogen? — It is a colourless, inodourous gas; the lightest of all ponderable bodies; inflammable, and capable (when mixed with oxygen or atmospheric air in the proportion of two to one) of being exploded by flame, or by an electric spark; incapable of supporting combustion or respiration, and producing a remarkable alteration in the voice when breathed.

What is the symbol, and what the specific gravity, and equivalent number, of hydrogen?—Its symbol is H; its specific gravity, 0·0689; its equivalent number, 1.

What are the proportions of hydrogen and oxygen in water? — One volume of hydrogen to half a volume of oxygen (the combining proportion of oxygen being one-half the size of that of hydrogen).

How may water be formed artificially? — By burning a jet of hydrogen in a vessel containing oxygen, water will be condensed upon the sides of the vessel.

What substance is generally contained in water?—Atmospheric air.

How may this be proved? — By exposing water to the action of an air-pump, when bubbles of air will escape in rapid succession.

What term is applied to bodies from which all the moisture has been expelled? — They are said to be anhydrous.

What term is applied to those bodies in which water exists as an

essential constituent? — They are called hydrates, excepting the combination of water with the acids, with which water acts as a base.

What term is applied to acids containing water? — The term aqueous or hydrous is prefixed.

How does water act with the alkalies and alkaline earths?—It acts as an acid; combining with them with much heat, as in the case of lime.

What is the specific gravity, and what the symbol, equivalent, and boiling and freezing points of water? — Its specific gravity is 1; its symbol H O; its equivalent 9; its boiling point, under the ordinary pressure of the atmosphere, 212°, and its freezing point, 32° of Fahrenheit.

What other compound of oxygen and hydrogen is there? — Deutoxide, or peroxide, or binoxide of hydrogen, or oxygenated water; consisting of two proportions of oxygen to one of hydrogen.

How is it obtained? — By dissolving deutoxide of barium in liquid muriatic acid (a saturated solution of chloro-hydric, or hydro-chloric, or muriatic acid in water), and precipitating the baryta (or protoxide of barium) by sulphuric acid, and the chlorine by silver.

What are the properties of deutoxide of hydrogen?—It is a colourless liquid, of a specific gravity of 1·452; of a pungent metallic taste; acting upon the skin like a caustic; whitening vegetable colours; has never been frozen by any degree of cold; is more slowly volatilized than water; and explodes violently when heated, or when brought in contact with finely-divided gold, silver, or platinum.

What effect is produced by throwing a jet of hydrogen upon a piece of dry platinum sponge? — The sponge becomes red hot and sets fire to the hydrogen.

To what are these phenomena (of the decomposition of deutoxide of hydrogen, and the combustion of hydrogen by the presence of platinum) attributed? — To the operation of a principle not yet explained, and which has received the name of catalysis, or the action of *presence*.

How may the quantity of oxygen or of hydrogen in any gaseous compound be determined? — By introducing a quantity of the mixture in a graduated tube over water, and causing it to explode by an electric spark; the diminution in the quantity of the mixture denotes the quantity of oxygen and hydrogen which have disappeared (having been converted into water); one-third of the quantity which has disappeared representing the oxygen, and two-thirds the hydrogen.

What caution is necessary? — That a slight excess of hydrogen be present to insure the explosion.

What name is given to this process? — It is called eudiometry, and was first used to analyze the atmospheric air.

What compound does hydrogen form with chlorine? — Chlorohyric, or hydrochloric, or muriatic acid, composed of equal volumes of chlorine and hydrogen.

What takes place when equal volumes of these gases are exposed at the same time to the rays of the sun? — They combine with an explosion, without any reduction of volume.

How may chlorohydric or hydrochloric acid be obtained? — By introducing, into a tubulated retort, a certain quantity of chloride of sodium or common salt, and adding, in divided portions, three-fourths as much (by weight) of strong sulphuric acid; and collecting the gas evolved by means of a pneumatic trough, in which mercury is used instead of water.

What is the *rationale* of this process?—The water in the sulphuric acid is decomposed, its oxygen uniting with the sodium to form oxide of sodium or soda, with which the sulphuric acid combines, to form sulphate of soda; while the hydrogen of the water and the chlorine of the chloride unite to form chlorohydric acid, which is collected over the mercury in the pneumatic trough.

What are the properties of chlorohydric or hydrochloric acid? — It is a colourless gas, incapable of being inflamed or of supporting combustion; producing extremely irritating and even fatal effects when breathed; it has a great affinity for water, which absorbs four hundred and twenty times its own bulk of the acid; when allowed to escape into the air it gives rise to white fumes, from combining with moisture; and is rendered liquid when subjected to a pressure of forty atmospheres.

What is its specific gravity? — 1·2694.

What takes place when it is brought into contact with the metallic oxides, or with those metals which decompose water?—When brought into contact with the metallic oxides, the oxygen of the oxide and the hydrogen of the chlorohydric acid unite to form water, while the chlorine unites with the metal to form a chloride; and the metals which decompose water unite with the chlorine of the chlorohydric acid, and free its hydrogen.

How may liquid muriatic or hydrochloric chlorohydric acid be procured? — By saturating water with the gas by means of Woulfe's apparatus; or by distilling a solution of chloride of sodium in water with sulphuric acid.

What are the properties of this liquid? — It is generally straw-coloured from the presence of iron, though when pure it is colourless; and, if strong, it produces suffocating fumes when exposed; its combinations with the alkalies, earths, and oxides, are always soluble.

What effect does heat produce upon its compounds?—It drives off the hydrogen and converts them into chlorides.

What are the muriates or chlorohydrates supposed by some to be? —Combinations of a chloride with water.

What compounds does hydrogen form with bromine and with iodine respectively? — Bromohydric and iodohydric acids (sometimes called hydrobromic and hydriodic), consisting of equal proportions of each of their constituents.

What compound does hydrogen form with fluorine?—Hydrofluoric or fluohydric acid, remarkable for its volatilizing at a little below 60°, and for its power of corroding glass.

What compounds does hydrogen form with sulphur? — Sulphydric (or hydrosulphuric) acid, commonly called sulphuretted hydrogen; an indefinite compound, called the polysulphuret or polysulphide of hydrogen, composed of one proportion of hydrogen with four, six, or even eight of sulphur.

How may sulphydric acid be obtained? — By the action of diluted sulphuric acid upon a sulphide or sulphuret.

What is the *rationale?*—Water is decomposed; its oxygen uniting with the metal to form an oxide, with which the sulphuric acid unites to form a sulphate; while the hydrogen of the water and the sulphur unite to form sulphydric acid, which is evolved.

Where does it exist in nature? — In the water of many mineral springs.

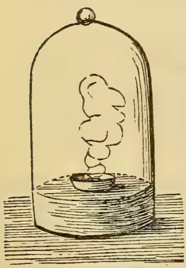
What is its composition, and what are its properties? — It is composed of equal proportions of sulphur and hydrogen; is a gas of very fetid odour, absorbed by water, and decomposed by mercury, and requiring to be collected over water saturated with salt; it reddens vegetable blues, and combines with many of the metals, precipitating them from their solutions (particularly the preparations of lead); is fatal to animal life; does not support combustion; is inflammable, and decomposed by chlorine, potassium, sodium (and other metals which have an affinity for both sulphur and hydrogen), or by being exploded by electricity.

NITROGEN.

Where does nitrogen exist in nature? — In the atmosphere, mechanically mixed with oxygen, and a small quantity of aqueous moisture and carbonic acid.

How may nitrogen be obtained? (Fig. 275.) — By burning phosphorus in a vessel containing air, until all the oxygen is consumed; or by introducing a mixture of iron filings and sulphur, moistened, with which the oxygen combines to form a sulphate, leaving the nitrogen, which must be purified from carbonic acid by means of lime water.

Fig. 275.



What are the properties of nitrogen? — It is a colourless gas, incapable of supporting animal life, or combustion; destitute of any active properties, except that it has a great affinity for caloric; and is an ingredient in almost all the fulminating compounds.

Give its symbol, equivalent number, and specific gravity. — Its symbol is N; its equivalent, 14·15; its specific gravity, 0.9727.

What is the composition of the atmospheric air? — Not quite four-fifths of its bulk is nitrogen; a little more than one-fifth of oxygen; and a very small proportion of carbonic acid gas, and aqueous vapour.

What is that process called, by which the air may be analyzed, and the proportions of its constituents determined? — Eudiometry. (See Hydrogen.)

How may the quantity of moisture in the air be ascertained?—By an instrument called an hygrometer.

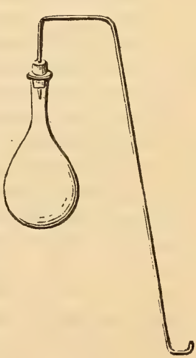
What chemical compounds does nitrogen form with oxygen? — Nitrous oxide, containing one volume of nitrogen, and half a volume of oxygen; nitric oxide, containing one volume of nitrogen, and one of oxygen; hyponitrous acid, containing one volume of nitrogen, and one and a-half of oxygen; nitrous acid, containing one volume of nitrogen, and two of oxygen; and nitric acid, containing one volume of nitrogen, and two and a-half of oxygen; each volume of oxygen containing two combining proportions.

How may nitrous oxide be obtained? — By the action of dilute nitric acid upon zinc; by exposing nitric oxide gas to iron filings, which take from it one proportion of its oxygen; or by heating nitrate of ammonia, and collecting the gas over water saturated with salt. (Fig. 276.)

Nitrate of Ammonia 80	Nitric acid 54	Nitrogen 14	Protox. nitrogen 22
		Oxygen 8	
		Oxygen 8	
		Oxygen 24	
	Ammonia 17	Nitrogen 14	Protox. nitrogen 22
		Hydrogen 3	Water 27
	Water 9		Water 9.

What is the *rationale* of the last method? — The nitric acid contains one volume, or proportion of nitrogen, and two and a half volumes, or five proportions of oxygen; and the ammonia contains one volume of nitrogen, and three of hydrogen; and three volumes of hydrogen take one and a half volumes, or three proportions of oxygen, and form water, while the remaining volume, or two proportions of oxygen, unite with the two of nitrogen, to form nitric oxide.

Fig 276.



What are the properties of nitrous oxide? — It is a colourless gas, absorbed by water; supporting combustion almost as well as oxygen, explodes and forms water and free nitrogen, when inflamed with hydrogen; and when breathed, at first intoxicates, but if long continued, produces death.

What other name is sometimes given to it?— Laughing gas; from its peculiarly exhilarating and intoxicating effects.

How is nitric oxide formed?—It is given off during the action of nitric acid upon the metals.

What are its properties?—It is a colourless gas, irritating, and incapable of being respired; extinguishes the flame of a candle, but supports the combustion of previously-ignited charcoal, or phosphorus; ignites Homberg's pyrophorus; is slightly absorbed by water; absorbs oxygen from the air, and gives rise to red fumes of nitrous acid gas; when mixed with hydrogen, in equal quantity, it is inflammable, forming water and nitrogen; explodes with ammonia; does not redden vegetable blues; and is decomposed by freshly-ignited platinum sponge, by moistened iron filings, by strong heat, and by repeated shocks of electricity.

In what process is it used?—In eudiometry, or analysis of air.

What is its specific gravity?—It is heavier than air, having a specific gravity of 1·0375.

By what other names is it sometimes designated?—Deutoxide, or binoxide of nitrogen, and nitrous air.

What are the properties of hyponitrous acid?—It is a dark, green liquid, extremely volatile, and is not used in the arts.

How is nitrous acid procured?—By mixing two volumes of nitric oxide (containing one proportion of nitrogen, and two of oxygen), with one volume (containing two proportions) of oxygen; or by heating nitric acid in contact with air, and collecting the fumes; or by distillation from the nitrate of lead.

What are the properties of nitrous acid?—When moist, it is a gas of a deep red colour; irritating, and incapable of being respired; supports the combustion of moist bodies, but extinguishes burning sulphur; when dry or anhydrous, it is a lemon-coloured liquid, of a density = 1·451, very volatile; is decomposed by heat, and also by the metals, to which it gives up a portion of its oxygen; when mixed with water, it is converted into nitric acid and nitric oxide, and if the quantity of water be small, the change takes place slowly, the water becoming successively blue, green, yellow, and orange.

What is the commercial name of nitric acid?—Aqua fortis.

With what substance is it always combined?—With a small quantity of water.

How is it obtained—By the action of sulphuric acid and heat upon nitrate of potassa, commonly called nitre, or saltpetre.

What is the *rationale?*—It is a case of simple affinity, or single elective attraction; the sulphuric acid has an affinity for potassa superior to that of nitric acid, unites with the potassa, and sets free the nitric acid, which is vaporized by the heat, and passes over into a receiver, and is condensed.

How may nitric acid thus obtained be purified?—The sulphuric acid may be precipitated from it by baryta, and the chlorohydric acid by a solution of silver.

What are the properties of nitric acid?—It is colourless when

pure; but as it is found in commerce, it is of an orange colour, from the presence of nitrous acid or nitric oxide; when concentrated it has a specific gravity of 1·55, boils at 175°, and freezes at —40° of Fahrenheit; the officinal nitric acid has a gravity of 1·5, boils at 248°, and contains two proportions of water to one of acid; it reddens vegetable blues; acts as a caustic upon animal tissues; and reacts with almost all the metals except silver; and is used in medicine, and as a colouring material.

What name was formerly given to a mixture of nitric and muriatic, or chlorohydric acids?—It was called aqua regia, from its property of dissolving gold.

What is nitroso-nitric acid?—An orange-coloured fuming liquid (resulting from the absence of a sufficient quantity of water during the formation of nitric acid), consisting of a mixture of nitric acid, and nitric oxide or nitrous acid.

What are its properties?—It ignites the essential oils and carbon, and burns explosively with phosphorus; and when exposed to heat, gives up nitrous acid gas, and is converted into pure nitric acid.

What combinations does nitrogen form with chlorine and iodine?—A chloride, and an iodide of nitrogen, remarkable for their explosive properties.

What combination does nitrogen form with hydrogen?—Ammonia, frequently called volatile alkali, consisting of one equivalent of nitrogen, and three of hydrogen.

How is ammonia obtained?—By mixing equal parts of unslaked lime (oxide of calcium) and sal ammoniac (chlorohydrate or hydrochloride or muriate of ammonia), both pulverized, applying heat, and collecting the gas over mercury.

What is the *rationale?*—The chlorohydric acid having a greater affinity for lime than for ammonia, unites with the former to form a muriate or chlorohydrate of lime, while the ammonia escapes.

What are the properties of ammonia?—It is a colourless gas, of a very pungent odour, very irritating to the eyes and nose; is incapable of being respired, or supporting combustion, or of being inflamed in the air; it inflames with chlorine spontaneously, is exploded with oxygen, and by the electric spark; it restores vegetable colours that have been changed by acids, and changes the colour of turmeric from yellow to brown; combines with and neutralizes the acids; is absorbed rapidly by water, which takes up from 450 to 670 times its own bulk; it has a specific gravity of 0·5897; and is rendered liquid by intense pressure, or by a temperature of —40° of Fahrenheit.

How is the aqua ammoniæ, or liquid ammonia obtained?—By conveying the gas into water surrounded by ice, until the water becomes saturated with the gas.

Why is it necessary to surround the water that is to be saturated

with ice?—Because the absorption of the gas would, otherwise, cause such an elevation of temperature as would interfere with the process.

What is the name of the amalgam which has been discovered by means of the voltaic circuit acting with muriate of ammonia and mercury? — Ammonium.

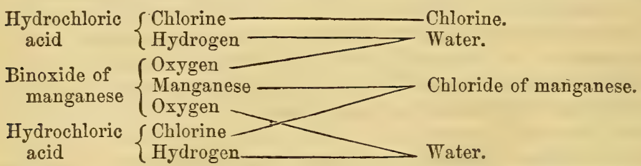
CHLORINE.

How does chlorine exist in nature?—Only in combination; and in most abundance in marine salt.

What was chlorine formerly supposed to be?—Oxygenated muriatic acid, or oxymuriatic acid.

How is it obtained?—It is obtained by heating in a retort binoxide of manganese with chlorohydric, or hydrochloric, or muriatic acid, and collecting the gas over a pneumatic trough or cistern.

What is the *rationale* of this process? — The muriatic acid is decomposed into its elements of chlorine and hydrogen, and the binoxide of manganese gives up oxygen, which unites with the hydrogen to form water, while the chlorine escapes, or thus —



What are the properties of chlorine? — It is a gas of a greenish-yellow colour; becoming liquid under great pressure; a non-conductor of electricity; a good supporter of combustion, and incapable of supporting animal life; proving fatal when respired; imparts to the hand a sensation of warmth; is absorbed by water; and is much used for bleeching.

How does it act in bleeching? — It decomposes the water, combining with the hydrogen to form chlorohydric acid gas, and, freeing the oxygen, enables it to act upon the colouring matter.

What precaution is necessary in collecting chlorine over water in the pneumatic trough? — To saturate the water with common salt; or to cork and remove the gas bottles from the water as soon as they are filled, to prevent the absorption of the gas.

How may chlorine be shown to be a supporter of combustion? — By introducing phosphorus, or Dutch gold-leaf, or powdered antimony into the gas; when they will immediately take fire.

What is the symbol, and what the chemical equivalent, and the specific gravity of chlorine? — Its symbol is Cl, its chemical equivalent is 36 (or more nearly 35·42), and its specific gravity 2·47.

Has chlorine gas ever been condensed to the form of a liquid? — Yes; by a pressure of about four atmospheres, into a yellow limpid liquid.

What termination is given to the non-chloro-acids?—The termination *ide*, as chloride of calcium.

What are the principal combinations formed by oxygen and chlorine?—Euchlorine or protoxide of chlorine, or hypochlorus, and composed of half a volume of oxygen[1] and one of chlorine; chlorous acid, or tritoxide or peroxide of chlorine, composed of one and a half volumes of oxygen to one of chlorine; chloric acid, composed of two and a half volumes of oxygen to one of chlorine; and oxychloric or perchloric acid, composed of three and a half volumes of oxygen to one of chlorine.

What are the properties of euchlorine or protoxide of chlorine?—It is a gas of an orange-yellow colour, slightly greenish; first reddening and afterwards whitening vegetable blues; absorbed by water; supporting combustion for a very short time; and exploding when brought into contact with phosphorus, Dutch gold-leaf, powdered antimony, or arsenic, or when heated to 100° of Fahrenheit; occupying one-fifth more space after explosion.

What is this supposed by some to be?—A mixture of chlorous acid and chlorine.

What are the properties of chlorous acid?—It is a gas of a deep-yellow colour, of an aromatic odour; is absorbed by water; whitens vegetables blues; is exploded by artificial heat or by the rays of the sun; and may be liquified by great pressure.

What are the properties of chloric acid?—It is an oleaginous liquid; colourless, sour and astringent; reddens vegetable blues; and is an exception to the rule that the compounds of chlorine precipitate the salts of silver from their solutions.

What are the properties of perchloric acid?—It exists only in the liquid form, and in combination with water; is transparent, colourless, sour to the taste, reddens vegetable blues, and is less easily decomposed than any other of the combinations of oxygen and chlorine.

What compound is formed by chlorine and hydrogen, and how is it prepared?—Chloride of hydrogen, prepared by transmitting chlorine gas through a solution of muriate of ammonia. It is a highly explosive compound.

Does not chlorine form compounds with carbon, carbonic acid, phosphorus, boron, and silver?—Yes.

BROMINE.

Where does bromine exist in nature?—In the water of the ocean, of the Dead Sea, and of most of the salt springs in Europe, in the form of hydrobromate of magnesia, and has lately been discovered in a spring in this State.

How is it obtained?—The mother water of marine or common salt

[1] It must be kept in mind that one volume of oxygen contains two combining proportions; they being half the size of those of chlorine or hydrogen.

is impregnated with chlorine, till it acquires a hyacinth-red tinge; the chlorine combines with the hydrogen and earth of a hydro-bromate of magnesia which exists in that water; the bromine thus displaced mingles with the water which is to be washed with ether; the etherial solution of bromine being treated with potash, a bromide of potassium is produced, which, by the combined action of heat, sulphuric acid and manganese, evolves bromine.

What are the properties of bromine? — It is a liquid of a dark red colour; boiling at 89°, and becoming solid at from —7° to —12° below zero of Fahrenheit; very volatile, emitting red-coloured fumes; is slightly soluble in water, alcohol, and ether; whitens vegetable blues, produces a yellow colour with starch, does not support combustion; is destructive of animal life; and resembles chlorine in its properties and combinations.

What are its principal combinations? — With oxygen it forms bromic acid; with hydrogen, bromohydric, or, as it is usually called, hydrobromic acid; and, with various radicals, it forms bromides.

How is bromine most easily detected? — By means of chlorine, which displaces it from its combinations.

What is the symbol of bromine, and what its specific gravity and chemical equivalent? — Its symbol is Br., its specific gravity is (compared with water) 2·966, its chemical equivalent is 78·4.

IODINE.

Where does iodine exist in nature? — In sponges and various seaweeds; and in the waters of various mineral springs.

How is it generally obtained? — From the lixivium or lye which remains after the manufacture of carbonate of soda; the residuum is treated with sulphuric acid and heat in a retort, when the iodine passes over in the form of crystals of an intensely purple or black colour.

What are the properties of iodine? — It is a bluish-black solid, of a metallic lustre, brittle, and almost insoluble in water, but is soluble in alcohol and ether; it melts at 225°, and volatilizes at 350° when dry; but when moist, at a temperature lower than that of boiling water; is a non-conductor of electricity; is an acrid poison when taken in large quantities; does not burn in oxygen; produces a deep blue or purple colour with starch; and its vapour is incapable of supporting respiration.

What is its symbol, and what its specific gravity and chemical equivalent? — Its symbol is I, its specific gravity, when solid, is 3·0844; when in the form of vapour, 8·716 (compared with air as the unit); its equivalent is 126·3.

How may starch be used as a test for iodine? — The liquid to be tested should first be rendered slightly acid, by means of nitric acid, when, by adding starch (if iodine be present), a dark purple iodide of starch will be formed; or the liquid may be tightly corked, and a

piece of moist paper, sprinkled with the powdered starch, suspended from the cork; and if iodine be present, iodide of starch will be precipitated upon the paper.

How may starch be detected by means of iodine?—The liquid may be boiled with a small quantity of starch, and a watery solution of chlorine, or a small quantity of sulphuric acid, added through a tube passing to the bottom of the liquid, when the acid will set the iodine free, and allow it to act upon the starch, producing the characteristic blue or violet colour.—[*Hare's Chemistry.*]

What compounds does iodine form with hydrogen, oxygen, chlorine, and bromine? — With hydrogen, it forms hydriodic acid; with oxygen, iodic and hyperiodic, or oxyiodic acid; with chlorine, a protochloride and a perchloride; and with bromine, a protobromide and a perbromide.

FLUORINE.

How does fluorine exist in nature? — It exists in most abundance in Derbyshire or fluor spar, which is a fluoride of calcium.

For what is it most remarkable? — It is remarkable for the corrosive nature of its compounds, one of which (fluohydric acid) even corrodes glass.

Has fluorine ever been obtained in a separate state? — Yes, very lately.

What is its symbol, and what its equivalent? — Its symbol is F.; its equivalent, 18·68.

What combinations does fluorine form with hydrogen, bromine, and silicon? — Hydrofluoric or fluohydric acid, fluoboric and fluosilicic acids (and it forms none with oxygen).

SULPHUR.

How is sulphur obtained? — It is obtained by sublimation from numerous combinations existing in nature, commonly called pyrites or sulphurets.

What are the properties of sulphur? — It is a brittle solid, of a pale greenish-yellow colour: odorous when rubbed; insoluble in water, but soluble in boiling oil of turpentine; is a non-conductor of electricity, and becomes negatively electrified by friction; undergoes a feeble combustion at 180°, melting at 225°, and is sublimed, when in close vessels, at 600°; being deposited, upon cooling, in the form of minute crystals, known as flowers of sulphur.

How may it be rendered ductile? — By heating it to 428°, and pouring it into water.

How may sulphur be obtained in crystals of appreciable size? (Fig. 277.) — By melting it, and allowing it to cool partially; and then piercing the outer crust, and pouring off the still fluid portion.

How may sulphur be made to unite with alcohol? — By bringing the two substances into contact in the state of vapour.

How may sulphur and water be made to combine? — By boiling them together with lime and chlorohydric, or muriatic acid, filtering, and adding sufficient muriatic acid to form a soluble muriate of lime, which remains in solution, while the sulphur is precipitated in the form of a hydrate of sulphur, denominated, by the pharmacopœias, *lac sulphuris.*

Fig. 277.

What is the symbol, and what the specific gravity, and the equivalent number of sulphur? — Its symbol is S; its specific gravity is 1·99; its chemical equivalent 16·1.

What are the combinations of sulphur with oxygen?—Sulphurous acid, containing one proportion of sulphur, and two of oxygen; sulphuric acid, = one of sulphur, and three of oxygen; hyposulphurous acid, = two of sulphur, and two of oxygen; and hyposulphuric acid, = two of sulphur, and five of oxygen.

Describe the formation and properties of sulphurous acid. — It is formed by the ordinary combustion of sulphur in atmospheric air, or in oxygen; is a colourless gas of a pungent sulphurous odour, fatal to animal life, incapable of supporting combustion, and reddens vegetable blues.

How was sulphuric acid formerly obtained? — By distillation from sulphate of iron, or green vitriol; from which it took the name of oil of vitriol.

How is it now usually obtained? — By burning sulphur, previously mixed with one-eighth of its weight of nitrate of potassa or nitre, and conducting the vapour into a leaden chamber containing water.

What is the *rationale* of this process? — The nitric acid of the nitrate of potassa (containing one proportion of nitrogen, and five of oxygen), is decomposed, giving up three parts of oxygen, which unite with a portion of the sulphur to form sulphuric acid; the sulphuric acid combines with the potassa, to form sulphate of potassa; while the remaining portion of the sulphur is converted into sulphurous acid by uniting with the oxygen of the air; the nitric acid, having been converted into nitric oxide by the loss of three parts of oxygen, combines with the oxygen of the air, and forms nitrous acid; the sulphurous and nitrous acids then unite with the aqueous vapour in the leaden chamber, to form a crystalline compound, which, upon falling into the water is decomposed, and the nitrous acid gives up one proportion of its oxygen to the sulphurous acid, by which the sulphurous is converted in sulphuric acid, which combines with the water, while the nitrous acid is changed into nitric oxide, which again combines with the oxygen of the air, sulphurous acid, and moisture, to form more of the crystalline compound.

How is the sulphuric acid finally obtained? — By evaporating the water, and distilling the acid to free it from sulphates of potassa and

lead; taking care, if the retort be of glass, to introduce some pieces of platinum, the presence of which enables the acid to boil without endangering the glass.

What are the properties of sulphuric acid? — It is a dense, colourless, oily fluid; having a strong affinity for the alkalies and for water, with which, when mixed in the proportion of three of acid, to one of water, it produces great heat; it explodes when mixed with hot water; reddens vegetable blues, and boils at 620°.

What is its specific gravity? — From 1·847 to 1·850, when in its most concentrated form.

What is the best test for sulphuric acid? — Baryta, with which it forms an insoluble precipitate of sulphate of baryta.

What phenomena are produced by sulphur when heated in contact with the metals? — If the metals be finely divided, combustion ensues, which also takes place when iron is exposed to a jet of the vapour of heated sulphur.

What are the combinations of sulphur with chlorine, bromine and iodine? — With chlorine it forms two compounds, one of which contains 2 atoms of sulphur, and one of chlorine; and the other, one atom of each; with bromine it forms a reddish, oleaginous fuming liquid; and with iodine, an iodide, of a steel gray colour.

What other acids of sulphur have been discovered?—Sulphuretted hyposulphuric acid S_3O_5, and bisulphuretted hyposulphuric acid, S_4O_5.

SELENIUM.

What is selenium? — A rare substance, resembling sulphur in its chemical relations; it is a reddish brown, solid body, somewhat translucent; sp. gr. 4·3, at 212° it melts, and at 650° boils; insoluble in water, and emits a disagreeable odour when heated in the air. It belongs to the basacigen class of Dr. Hare; symbol, Se.

What combinations does it form with oxygen?—Oxide of selenium, selenious, and selenic acids.

PHOSPHORUS.

From what may phosphorus be obtained? — From bones, in which it exists as a phosphate of lime; or from urine, in which it exists as a phosphate of soda.

How is it obtained from bones? — The bones are first burned until the animal matter contained in them is destroyed, sulphuric acid is then added, which unites with the lime and sets the phosphoric acid free; the oxygen is separated from the phosphoric acid by igniting it with charcoal or carbon, which unites with the oxygen, and the phosphorus escapes from the retort, and is condensed in the water in which the beak of the retort is immersed.

How is phosphorus obtained from urine? — By adding nitrate of lead; the nitric acid of which unites with the soda, and the phospho-

ric acid of the phosphate of lead unites with the oxide of lead to form phosphate of lead, from which the phosphorus may be distilled with charçoal, and condensed in water, as in the former process.

How is phosphorus afterwards prepared for use ?—By being melted in hot water, and pressed through chamois leather.

What are the properties of phosphorus ? — When pure, it is colourless and translucent; but, as generally found, it is of a fleshy colour, and of a lustre and consistence resembling wax; emitting a peculiar odour, from its combining with oxygen; is rendered brittle by a very small proportion of sulphuric acid; undergoes a slow combustion in the open air at ordinary temperatures; is readily ignited by friction; melts at 108°; inflames at 148°; is vaporized at 550°; when ignited in oxygen burns with extreme brilliancy; is insoluble in water; but is soluble (with the aid of heat) in naphtha, and in the fixed and volatile oils.

What is the specific gravity, and what its symbol and the chemical equivalent of phosphorus ? — Its specific gravity is 1·77, its symbol is P., its equivalent 16, or more accurately 15·7.

What combinations does it form with oxygen? — Oxide of phosphorus = one proportion of oxygen and three of phosphorus; hypophosphorus acid = three of oxygen and two of phosphorus; and phosphoric acid = five of oxygen and two of phosphorus.

How is phosphoric acid obtained ? — By adding sulphuric acid to a solution of phosphate of baryta; the sulphuric acid, by its superior affinity for baryta, precipitates an insoluble solution.

Can it ever be obtained entirely free from water? — It cannot, but it may be concentrated by evaporation.

What are its properties? — It is a viscid, inodorous, colourless liquid, reddening vegetable blues, and producing a yellow precipitate with nitrate of silver; and when heated to redness, acquires the property of corroding glass or porcelain.

What is formed when phosphoric acid is heated to a red heat, and allowed to cool? — A transparent, brittle glass, which produces a white precipitate with nitrate of silver; and has received the name of paraphosphoric or metaphosphoric acid, or monobasic phosphoric acid.

What effect is produced upon paraphosphoric acid by exposure to the air? — It deliquesces, and is converted into phosphoric acid.

What name is given to the acid contained in phosphate of soda after it has been exposed to a red heat? — Pyrophosphoric acid, or bibasic phosphoric acid.

What are these three acids said to be? — Isomeric bodies; because they consist of the same proportions of the same constituents, but differ in their properties.

What is the only other compound of phosphorus possessing any remarkable properties? — Perphosphuretted hydrogen, consisting of phosphorus and hydrogen united in proportions that have not been accurately ascertained.

What are its properties? — It is a colourless gas, having a bitter taste, and an odour like garlic; is absorbed in a slight degree by water; and when allowed to escape into oxygen or atmospheric air, it explodes with a brilliant flash, leaving a wreath of smoke, consisting of watery vapour and phosphoric acid.

Does phosphorus form compounds with chlorine, bromine, iodine, sulphur, and selenium? — Yes.

CARBON.

How does carbon exists in nature? — It exists in a state of purity in the diamond, and combined with various substances in coal, wood, animal matter, and plumbago.

How is it generally obtained for use? — It is obtained in a state sufficiently pure, in the form of charcoal, by heating wood to redness without access of air; so that the hydrogen and oxygen are driven off.

What are the properties of charcoal obtained from wood? — It is black, hard, brittle; without taste or smell; a very good radiator, but a bad conductor of heat; a very good conductor of electricity; insoluble in water; not affected by exposure to air and moisture; has a great affinity for oxygen; is acted upon with difficulty by nitric acid; is highly combustible, burning brilliantly in oxygen; absorbs large quantities of gases, and gives them up again when heated; and absorbs the odoriferous and colouring principles of most animal and vegetable substances.

What is animal charcoal? — Charcoal obtained from bones, usually in the form of a powder called ivory black; and principally used in the arts as a decolorizing and antiseptic material.

In what form is carbon sometimes precipitated in a pure state from coal gas? — In the form of long brittle filaments, resembling tufts of hair.

What is the symbol, and what the chemical equivalent and the specific gravity of carbon? — Its symbol is C., its equivalent number 6·12, its specific gravity, when in the form of diamond or of charcoal reduced to powder, is about 3·5.

What are the principal compounds of carbon and oxygen? — Carbonic oxide, consisting of one proportion or volume of carbon and one proportion or half a volume of oxygen; carbonic acid, = one proportion of carbon and two of oxygen; and oxalic acid, = two proportions or volumes of carbon, and three proportions, or one and a half volumes of oxygen.

How is carbonic oxide obtained? — By heating chalk (carbonate of lime) with iron filings; when one proportion of the oxygen unites with the iron, while one proportion of carbon and one of oxygen are liberated and form carbonic oxide, or by acting upon oxalic acid with sulphuric acid and heat, and passing the gas which escapes through

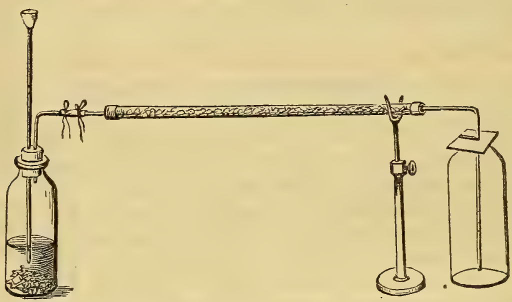
a solution of caustic potash, which combines with caroonic acid, which is formed at the same time while the carbonic oxide escapes.

What are the properties of carbonic oxide?—It is a colourless gas, not decomposed by heat or electricity; burns in oxygen, and is converted into carbonic acid; is incapable of supporting life or combustion; does not redden vegetable blues; and has a specific gravity of 0·9727; and has never been liquefied.

Where does carbonic acid exist in nature?—In limestone and marble, in the form of carbonate of lime, and in the atmosphere, and in various mineral springs.

How may it be obtained? (Fig. 278.)—By the action of heat or

Fig. 278.



of acids upon any of the carbonates, by the combustion of charcoal, and by the vinous fermentation.

What are its properties?—It is a colourless, inodorous gas, having a specific gravity of 1·5239; is fatal to life, or to combustion, even when diluted with four times its bulk of oxygen; reddens vegetable blues; is absorbed by water; is not inflammable; forms insoluble carbonates with lime, baryta, strontia, magnesia, and oxide of lead; is capable of being liquefied by a pressure equal to forty atmospheres, and also solidified, is antiseptic; and gives up its oxygen to potassium, which burns in it. (For oxalic acid, see *Organic Chemistry.*)

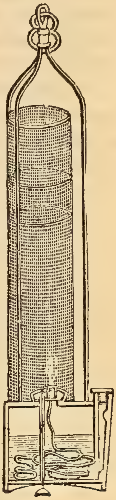
What are the general characteristics of the compounds of carbon and hydrogen?—Their inflammability; their inability to support respiration or combustion; the property that they possess of neutralizing powerful acids; and from many of them being isomeric, or consisting of the same ingredients in the same proportions; and some being also polymeric, or consisting of the same ingredients or elements in the same proportions, but differing in their degrees of condensation.

What are the most important of these?—Light carburetted hydrogen or fire damp, and deuto-carbo-hydrogen, or olefiant gas, sometimes called carburetted hydrogen or hydroguret of carbon.

How is light carburetted hydrogen or fire-damp generated?—It is

evolved from the mud of stagnant waters, and is also generated in many coal mines; but cannot well be prepared artificially.

Fig. 279.



What are its properties?—It is a colourless gas; incapable of supporting respiration; highly inflammable; and having a specific gravity equal to 0·5593.

What is the principal of Sir Humphry Davy's safety lamp? (Fig. 279.)—The inflammable gas passes through the gauze and burns upon the inside of the lamp, while the gas on the outside is prevented from taking fire, by the cooling effect produced upon the gas by its passage through the wire gauze, unless the gauze be allowed to become red hot, and a current of the inflammable gas were passed through it so rapidly, as not to allow it to be cooled.

How may olefiant gas be obtained?—By heating a mixture of alcohol and sulphuric acid; during which process the sulphuric acid takes the water which is essential to the constitution of alcohol, and leaves the gas; or the alcohol may be deprived of its water by passing its vapour through a red-hot porcelain tube.

What are the constituents and the properties of this gas?—It is composed of two volumes of carbon (in vapour), and two of hydrogen, condensed into one volume; is a colourless gas, having a specific gravity equal to 0 9808; is destructive to life when respired; burns brilliantly when ignited in oxygen, or atmospheric air, and is used for the purpose of illumination; explodes violently when mixed with oxygen and ignited; and forms, with chlorine, a yellow oily liquid, sometimes called chloric ether, this gas has been liquefied.

What is naphtha?—A volatile liquid, of a strong, peculiar odour, very inflammable; has a specific gravity equal to 0·753; boils at 158° of Fahrenheit; insoluble in water, but soluble in pure alcohol and in the oils; contains no oxygen, but consists of carbon and hydrogen in the proportion of 6 to 5; and is found native, or obtained by distillation from the tar of bituminous coal.

What important compound does carbon form with nitrogen?—Cyanogen, which is classed by Berzelius among the halogen, and by Professor Hare among the basacigen bodies.

How is it obtained?—By decomposing the bicyanide (or bicyanuret) of mercury by heat in a retort, and collecting the gas over mercury.

What are its properties?—It is a colourless gas, of a pungent and peculiar odour; extremely irritating, and incapable of supporting respiration or combustion; burns with a violet-coloured flame, from which it derives its name; is rendered liquid by pressure; and is solidified by cold; is absorbed by alcohol, and by water; is decomposed by

electricity; combines with various bodies as an electro-negative; and has a specific gravity equal to 1·8157.

What is its composition?—It is a bicarburet of nitrogen; containing two volumes of carbon and one of nitrogen, condensed into one volume.

What is its symbol and its equivalent number?—Its symbol may be written $2C + N$, or Cy; its equivalent is 26·39.

What is the most important compound of which cyanogen forms a part?—Cyanhydric acid, otherwise called hydrocyanic or prussic acid, consisting of one volume of cyanogen and one of hydrogen.

In what does prussic acid exist in nature?—In the leaves of the laurel and peach trees, and in the kernel of the bitter almond.

How is it obtained?—By the action of chlorohydric or hydrochloric, or muriatic acid upon bicyanide of mercury; the chlorine of the chlorohydric acid uniting with the mercury to form a chloride, while the cyanogen and hydrogen unite to form cyanhydric or prussic acid, which is condensed in a receiver surrounded with ice.

What are its properties?—It is a colourless liquid, having a powerful odour, resembling that of peach leaves; very volatile, boiling at 79°, freezing at 0°, and evaporating so rapidly, when exposed, that one portion is frozen by the evaporation of the other; is extremely poisonous when its vapours are breathed, or when it is spilt upon the skin; has a very slight acid action, scarcely reddening vegetable blues; and is decomposed by the metallic oxides, forming with them, by an interchange of elements, cyanides or cyanurets of the metals and water; its specific gravity is 0·7058.

Does cyanogen combine with sulphur, chlorine, bromine, and iodine?—Yes.

BORON.

From what source is boron obtained?—From borax, which is a native biborate of soda.

How is the process conducted?—Sulphuric acid is added to a saturated solution of the biborate of soda in water, when the sulphuric acid unites with the soda, displacing the boric or boracic acid, which is precipitated in the form of crystals, and from which boron is obtained by heating the acid in contact with potassium, which takes away its oxygen.

What are the properties of boron?—It is a solid, of a dark olive colour, insipid, inodorous, slightly soluble in water, and insoluble in alcohol, ether, or the oils; is a non-conductor of electricity, is infusible, but when heated in air or oxygen, to 600° Fahrenheit, its surface takes fire, and forms a crust of boric acid around the interior portion, which is rendered denser and more difficult of ignition.

What is the symbol, and what the equivalent number and specific gravity of boron?—Its symbol is B; its equivalent is 11 (or nearer 10·9); its specific gravity 1·83.

What are the properties of boric (or boracic) acid? — It is a crystalline-solid, consisting of one combining proportion of boron and three of oxygen; is changed into the form of a glass by heat, which deprives it of its water of crystallization; is colourless, inodorous, slightly soluble in water; infusible, and at low temperatures displaced from its combinations by sulphuric and nitric acids; but at a higher temperature they, in turn, are decomposed by heat and displaced by boric acid.

SILICIUM, OR SILICON.

How is silicon obtained? — By heating sulphuric acid with Derbyshire spar (fluoride of calcium), and powdered quartz or rock crystal (silicic acid); and heating potassium in the gas thus obtained.

What is the *rationale* of this process? — The sulphuric acid combines with the calcium and oxygen to form sulphate of lime, while the fluorine and silicic acid combine to form fluoride of silicon, which, being heated with potassium, the fluorine and potassium unite to form fluoride of potassium, and the silicon being insoluble, may be obtained separately, by repeated washing in water.

What are the properties of silicon? — It is a dark brown solid; a non-conductor of electricity; incapable of fusion, or volatilization; insoluble, except in a mixture of nitric and fluohydric acids; and as ordinarily obtained burns readily in oxygen, or atmospheric air; but after being exposed to a high temperature is incombustible; inflames when heated to redness in contact with the carbonates of the fixed alkalies, or with nitrate of potassa; and explodes when dropped upon the fused hydrates of potassa, soda, or baryta.

What is its symbol and what its chemical equivalent?—Its symbol is Si, its chemical equivalent 8, or more accurately, 7·5.

How does silica or silicic acid exist in nature? — In quartz, and especially in rock crystal, which is pure silicic acid.

How may it be obtained? — By melting together powdered quartz and pearlash (or carbonate of potassa), a glass is formed which, when dissolved in water, forms liquor silicium, or liquor of flints, which is a solution of the silicate of potassa, and from which silicic acid may be precipitated by adding another acid which combines with the potassa.

What are its properties? — It is a white powder, without taste or smell; of a specific gravity of 2·66; does not redden vegetable blues; is infusible, except by the compound blow-pipe; cannot be volatilized; is soluble in water when in its forming state, but insoluble after exposure to heat, or when crystallized; and consists of oxygen and silicon, each one combining proportion.

What is glass? — A silicate of potassa, the clearer kinds containing, also, oxide of lead.

ZIRCONIUM.

How is this prepared, and what is its equivalent?—By heating the double fluoride of zirconium and potassium with potassium, and separating the salt by cold water; its equivalent is 33·62, symbol Zn.

METALS.

What are the essential properties of the metals?—They are conductors of heat and electricity; are opaque even when reduced to very thin leaves; have a peculiar lustre, termed metallic; they act as electro-positives.

How do they differ among themselves?—In the degree and permanence of their lustre; in their malleability, ductility, elasticity, weight, tenacity, capability of oxidation, of being welded, of fusion, &c.

Which are the heaviest of the metals?—Platinum, gold, tungsten, mercury, palladium, lead.

Which are remarkable for ductility?—Gold, silver, platinum, iron, and copper.

Which are least capable of being oxidized?—Gold, silver, platinum, rhodium, nickel, and palladium.

What metals possess magnetic properties?—Iron, nickel, and cobalt.

What is meant by an alloy?—A compound formed by the union of two or more metals.

What is an amalgam?—A compound formed by union of mercury with another metal.

How are metals divided?—Into the metals of the earths proper, the metals of the alkaline earths, the metals of the alkalies, and the metals proper.

What are the peculiar properties of the earths proper?—They are white, insoluble in water, and do not affect vegetable colours; and are oxides of their respective metals.

What are the properties of the alkalies?—They are distinguished by their causticity, their solubility in water; by their restoring colours changed by the acids, and changing the colour of turmeric; and by their neutralizing the acids, forming with them salts which are neutral (that is, neither acid nor alkaline) in their properties; and are oxides of metals, which have so strong an affinity for oxygen as to decompose water.

What are the properties of the alkaline earths?—They resemble the alkalies in their effects upon colours, and in neutralizing the acids; and (excepting magnesia) are oxides of metals which decompose water; but only two of them are at all soluble in water.

What are the distinguishing properties of the proper metals?—Their oxides are insoluble in water, and do not effect vegetable colours; most of them form salts with the acids, but are separated from their combinations by the alkalies and alkaline earths.

What are the metals of the proper earths? — Aluminium, glucinium, yttrium, and thurium; and, according to some, zirconium and silicon.

ALUMINIUM.

How does aluminium exist in nature? — It exists in the form of aluminia or oxide of aluminium in clay, and in the ruby, sapphire, amethyst, topaz, and other gems; as a hydrate in certain stalactites; and in alum, which is a sulphate of alumina and potassa.

How may aluminium be obtained? — By heating alumina (oxide of aluminium) or chloride of aluminium with potassium.

What are its properties? — As ordinarily obtained, it is a gray powder, which is a non-conductor of electricity; when fused, it becomes a conductor of electricity; it fuses at a temperature higher than that required to melt iron; it takes fire when heated to redness in the air or in oxygen, or chlorine; and is not acted upon by water, or by nitric or sulphuric acids, without the aid of heat.

What is formed when aluminium is burned in oxygen? — A glass or vitrified oxide, which is so hard as to cut window-glass.

What is the symbol, and what the equivalent number of aluminium? — Its symbol is Al, its chemical equivalent 14, or, more accurately, 13·7.

How is alumina obtained? — It is obtained from a solution of alum, by adding an excess of carbonate of potassa to saturate the excess of sulphuric acid; dissolving the precipitate in chlorohydric acid, and precipitating it by ammonia, to remove the access of ammonia; this last precipitate is then washed, and the water expelled by heat.

What are the properties of alumina? — It is white, inodorous, fusible only by the blowpipe, does not affect vegetable colours, is insoluble in water, which it nevertheless absorbs, and is thus rendered plastic; it consists of two proportions of aluminium and three of oxygen, and is therefore a sesquioxide.

How may alumina be detected? — By using caustic potash, and soda, which occasion white gelatinous precipitates of hydrates of alumina, soluble in the excess of alkali. Ammonia produces a similar precipitate, in which is an excess of the alkali; the alkaline carbonates, and carbonate of ammonia precipitate the hydrate with escape of carbonic acid; the precipitates are insoluble in excess.

What are the metals of the alkaline earths? — Magnesium, calcium, barium, and strontium.

MAGNESIUM.

How is magnesium obtained? — By the action of potassium and heat upon the chloride of magnesium.

What are its properties? — It is a solid, of a metallic lustre, and white colour like silver; is malleable, and fusible at a red heat; is oxidized by moist air; it burns brilliantly, and is converted into mag-

nesia or protoxide of magnesium; takes fire spontaneously in chlorine; and is acted upon by dilute acids.

Give its symbol and chemical equivalent?—Its symbol is Mg; its equivalent, 12·7.

How is magnesia generally obtained?—It is obtained from sulphate of magnesia or Epsom salt, which exists in sea water, by adding a solution of potassa or soda (both of which form, with the sulphuric acid, soluble sulphates), and magnesia is precipitated.

What are the properties of magnesia?—It is a white powder, of a slightly alkaline taste; has a specific gravity of 2·3; is almost insoluble in pure water, but soluble in water containing carbonic acid; is separated from its combinations by the other alkaline earths, and by alkalies; is infusible except by the compound blow-pipe; and forms, with sulphuric acid, a sulphate which is soluble in water.

What are the various combinations which magnesium and magnesia forms with acids?—The chloride of magnesium, the sulphate of magnesia or Epsom salts, the carbonate of magnesia, the phosphate of magnesia, the phosphate of magnesia and ammonia, and the silicate of magnesia.

How may the salts of magnesia be recognised?—By the gelatinous white precipitates with caustic alkalies, including ammonia, insoluble in excess, but soluble in solution of sal ammoniac, by a white precitate, with the carb. potash and soda, but *none* with the carb. of ammonia when cold, and a white crystalline precipitate, with soluble phosphates, on the addition of a little ammonia.

CALCIUM.

How is calcium obtained?—By the action of a galvanic battery upon lime (protoxide of calcium) in contact with mercury; by which means the metal is deoxidized and unites with the mercury to form an amalgam, from which it is obtained by evaporating the mercury.

What are the properties, the symbol, and the equivalent of calcium?—It is a white metal, having a great affinity for oxygen, with which it combines spontaneously, forming lime; its symbol is Ca; its equivalent, 20·5.

How is lime or the protoxide of calcium obtained?—By the action of heat upon marble, limestone, or oyster-shells, in which lime exists in the state of carbonate; the carbonic acid being driven off by heat.

What are the properties of lime?—It is a white solid, composed of one proportion of oxygen and one of calcium; has a great affinity for water, with which it forms a hydrate, accompanied, at the same time, with a great increase of temperature; is slightly soluble in water, which takes up one seven-hundredth of its own bulk; is precipitated from limewater, or from its soluble salts, by carbonic or oxalic acid, in the form of carbonate or oxalate of lime; is fusible only by the compound blow-pipe; operates on vegetable colours like an alkali; and has a specific gravity of 2·3.

What are the various forms under which calcium presents itself? — As a protoxide in lime, a peroxide, a chloride, a sulphate of lime, a carbonate of lime, the phosphates of lime, the fluoride of calcium, the chloride of lime.

What is the most common test for lime? — Baryta, which on addition of a little sulphuric acid precipitates the lime.

BARIUM

How is barium obtained, and what are its properties? — It is obtained from baryta (protoxide of barium), by a process similar to that employed to obtain calcium; is a dark gray solid, of a lustre inferior to that of cast iron; when exposed to the air, it combines spontaneously with oxygen, forming baryta; is capable of being fused and evaporated at a heat below redness, and when in the form of vapour, acts violently upon glass; it decomposes water, combining with the oxygen and setting free the hydrogen; and is of a greater specific gravity than strong sulphuric acid.

Give its symbol and its chemical equivalent? — Its symbol is Ba, its equivalent 69, or, more accurately, 68·7.

How is baryta (or barytes) obtained? — By decomposing the native carbonate, mixed with charcoal, by exposing it to a white heat; or by the action of heat upon the native sulphate in contact with charcoal, by which means it is converted into a sulphuret of barium, and then, by adding nitric acid, into a nitrate of baryta, which must be filtered, evaporated, crystallized, and the acid drawn off by long-continued heat.

What are the properties of baryta? — It is a gray powder, having a specific gravity equal to 4; fuses at a very high temperature; slakes with water like lime, but is more soluble; absorbs water from the atmosphere and becomes white; is precipitated from all its solutions by sulphuric acid, for which it is the best test; its watery solution is rendered milky, and covered with a pellicle by absorbing carbonic acid from the atmosphere; is insoluble in alcohol; is acrid and poisonous; and acts like an alkali upon vegetable colours.

What are the various forms under which barium occurs? — As a protoxide of baryta, a peroxide, a chloride, a nitrate of baryta, a sulphate of baryta, a carbonate of baryta, and a sulphuret of barium.

What is the most important test for baryta? — Sulphate of lime.

What is the effect of the soluble salts of baryta upon the human system? — They are poisonous.

STRONTIUM.

How is strontium obtained, and what are its properties, &c.? — It is obtained from strontia (or strontites), in the same way that calcium is procured from lime, and is a metal of a dark grey colour, decomposing water, oxidizing quickly in the air, and strongly resembling barium.

Give its symbol and equivalent number. — Its symbol is Sr, its equivalent number 44, or, accurately, 43·8.

How is strontia obtained, and what are its properties? — It is obtained from the native carbonate, or sulphate, by a method similar to that for obtaining baryta; and is similar to baryta in most of its properties, but may be distinguished from it by being more soluble in boiling water, and less so in cold; by its compounds communicating a red colour to flame, and by their being destitute of poisonous properties.

What are its combinations? — The protoxide of strontia, the peroxide, the chloride and the nitrate of strontia.

Which are the metals of the alkalies?—Potassium, sodium, lithium, and ammonium.

POTASSIUM.

How is potassium obtained? —It is obtained by heating potassa, mixed with charcoal or with iron filings, to a white heat, in an iron gun-barrel, by which means the oxygen is separated from the potassa, and combines with the iron, or with the carbon of the charcoal; and potassium is condensed in the cool part of the apparatus.

What are the properties of potassium? — It is a solid, resembling silver in appearance, malleable, and soft at ordinary temperatures, and becoming brittle at 32°, breaking with a crystalline fracture; it melts at 106°, and is vaporized at a heat below redness; absorbs oxygen rapidly from the air, sometimes with flame; burns brilliantly when thrown upon water or ice, forming potassa, and a compound of hydrogen and potassium, which burns with a rose-coloured flame.

Give its symbol, equivalent, and specific gravity. — Its symbol is Po, or K (for kalium, from *kali*, the name for potassa); its equivalent is 40 (accurately, 39·15), and its specific gravity is 0·86.

How is potassa or protoxide of potassium obtained? — By lixiviation, or the formation of lye from wood-ashes, which is then evaporated, ignited so as to destroy the colouring matter, redissolved, boiled with lime, filtered, evaporated, dissolved in alcohol, again evaporated, and melted at a red heat, it has a great affinity for water.

What are its properties? — It is properly a hydrate of potassa; is of a grayish-white colour; has an alkaline taste; changes vegetable colours; neutralises acids; acts as a caustic upon animal fibre; deliquesces on exposure; is soluble in water; absorbs carbonic acid from the atmosphere; and fuses at a red heat.

What are some of the combinations of potassium?—The protoxide of potash, the peroxide of potassium, carb. of potash, the bicarb. of potash, the nitrate of potash or saltpeter, the sulphate of potash and bisulphate, and anhydrous bisulphate of potassa, the sesquisulphate of potash, the chlorate of potash, the hyperchlorate of potash, the sulphurets of potassium, the chloride of potassium, and the iodide and bromide, &c.

What are the tests for the salts of potash? — The salts of potash are colourless when not associated with a coloured metallic oxide or acid; they are all more or less soluble in water; a solution of acid tart. added to a solution of potash salt gives, after a time, a white crystalline precipitate of cream of tartar; a solution of chloride of platinum gives, under similar circumstances, a crystalline yellow precipitate, a double salt of platinum and potassium; alcohol increases the delicacy of both tests; salts of potash usually colour the outer blowpipe flame purple or violet.

SODIUM

How is sodium obtained? — It is obtained from soda in the same way that potassium is obtained from potassa.

What are its properties? — It resembles potassium in its properties and appearance, but does not become brittle at 32°, and decomposes water without a flame, and has a specific gravity of 0·97.

Give the symbol and chemical equivalent of sodium. — Its symbol is So, or Na (from *natrium*, the German name of sodium), its equivalent is 24 (or 23·3).

Whence is soda obtained, and what are its properties? — It is obtained from the ashes of sea-weeds, or from sea-salt (chloride of sodium), or from Glauber's salt (sulphate of soda), and resembles potassa in its properties, but may be distinguished by its efflorescing, instead of deliquescing; by being less soluble than potassa (although its *salts* are more soluble than those of potassa); by potassa forming a yellow precipitate with chloroplatinic acid, which soda does not; and by potassa being precipitated by citric acid.

What are the combinations of sodium?—A protoxide, or anhydrous soda, a peroxide, a hydrate, carbonate, bicarbonate, sulphate, bisulphate, hyposulphite nitrate, phosphate and biborate of soda, the sulphuret of sodium, and the chloride, iodide, and bromide.

What is the only test for soda? — The yellow colour imparted to the outer flame of the blowpipe.

What are the names of the metals proper? — Gold, platinum, silver, mercury, copper, lead, tin, bismuth, iron, zinc, arsenic, antimony, palladium, rhodium, iridium, osmium, nickel, cadmium, chromium, cobalt, columbium, manganese, molybdenum, titanium, tungsten, uranium, cerium, and vanadium.

GOLD.

How is gold obtained? — It is found pure, or else combined with other metals, from which it may be obtained by dissolving it in nitromuriatic acid, and precipitating the gold by sulphate of iron; or by the action of nitric acid, or of heat and air (as in cupellation), by which the other metals are oxidized.

What are the properties of gold? — It is the most malleable and ductile of all metals; fuses at a white heat; is not oxidized or vola-

tilized, except by the aid of electricity; is not soluble except in nitro-muriatic acid; its chloride is decomposed by sulphuric ether, which holds the gold in solution; it is also precipitated from its oxides in the metallic form by phosphorous, carbon, the baser metals, and by hydrogen and its compounds; and combines with oxygen and ammonia to form muriate of ammonia or fulminating gold.

Give its symbol, specific gravity, and chemical equivalent. — Its symbol is Au, its specific gravity is 19·3, its equivalent 200 (or 199·2).

What is the best test for gold? — Protochloride of tin; which throws down a purple precipitate, called the *purple of Cassius.*

Which is the most important compound of gold? — The perchloride, or terchloride.

PLATINUM.

How is platinum obtained? — It is obtained from the native grains by dissolving it in chlorohydric or muriatic acid, by which means chloroplatinic acid is formed, from which pure platinum may be obtained by adding chloride of potassium, igniting the precipitate, redissolving, precipitating by muriate of ammonia, and again igniting, and, finally, by heat and pressure, and condensing the *sponge* thus obtained.

What are the properties of platina?—It resembles silver in colour; is the heaviest of all metals, having a specific gravity equal to 21·53; is less malleable and ductile than gold; is capable of being welded at a high temperature, like iron; is not oxidized nor melted by the heat of a furnace, but is melted and oxidized by the galvanic battery, or by the compound blowpipe; is not a good conductor of heat; at high temperatures it combines with most of the metals, particularly lead and tin, and also with the hydrates of the alkalies; and when in the form of platinum sponge (providing it be dry), possesses the property of igniting a mixture of hydrogen and oxygen gases.

Give its symbol and chemical equivalent. — Its symbol is Pl, its equivalent is 98·8.

What is the best test for platinum? — Protochloride of tin, which throws down a claret-coloured precipitate.

What are the most important combinations of platinum? — Protoxide, and peroxide, the protochloride, and the per or bichloride of platinum.

SILVER.

How is silver obtained?—It is obtained from the alloys in which it exists, by amalgamation with mercury; or by cupellation or oxidation of the more oxidizable metal in a cupel; or when it is alloyed with gold, it may be separated by nitric acid (which acts upon silver, but not upon gold), provided that (if more than one-fourth of the alloy be gold), sufficient silver be added to make up the proper proportion. (This process is called quartation; and the separation by means of nitric acid is called parting.)

What are the properties of silver?—It is of a white colour and brilliant lustre; is very malleable, ductile, and soft when pure; is the best conductor of heat; fuses at a low white heat; is more easily tarnished by exposure than gold, and is blacked by sulphur and chlorine; is fused, oxidized, and dissipated by the compound blow-pipe; and is dissolved by nitric acid, but not by chlorohydric acid, nor by sulphuric acid, unless at a boiling heat.

Give its symbol, specific gravity, and chemical equivalent?—Its symbol is Ag, (from *argentum*, silver); its specific gravity is 10·5; its equivalent number, 108.

What are the precipitants of silver?—The chlorides, which throw down a white precipitate; and also the phosphates, chromates, and salts of arsenic, copper, and mercury.

What is the most important compound?—Nitrate of silver or lunar caustic, consisting of one proportion of silver and one of nitric acid.

What are the various combinations of silver?—The suboxide, protoxide, peroxide, nitrate, sulphate, hyposulphate, chloride, iodide, bromide, and sulphuret, and ammoniuret of silver or Berthollet's fulminating silver.

MERCURY.

How is mercury obtained?—It is obtained by distillation from cinnabar (which is a native sulphuret or sulphide of mercury) in contact with lime or iron filings, with which the sulphur combines, while the mercury is carried over pure, or sublimed.

What are its properties?—It is a metal of a colour and lustre resembling silver; but is liquid at ordinary temperatures, from which circumstance it has derived the name of quicksilver; is solidified at —39°, and boils at 600°; is not oxidized by exposure to air and moisture, unless adulterated with other metals, or in the form of vapour; when agitated for a long time in a bottle containing air, it forms an oxide called *Ethiops' mineral per se*, owing probably to the presence of some other metal.

What effects are produced upon mercury by acids?—It is dissolved by nitric acid, forming a nitrate; and when boiled with sulphuric acid, it takes oxygen from a portion of the acid, and the oxide thus formed combines with the remaining acid to form a sulphate; but mercury is not affected by any other acids.

Give the symbol, specific gravity, and chemical equivalent of mercury?—Its symbol is Hg, (from *hydrargyrum*); its specific gravity when liquid is 13·6, when solid, 14·4; its equivalent is 202.

What compounds does mercury form with oxygen?—Protoxide or black oxide, consisting of mercury and oxygen, each, one proportion; and peroxide or binoxide of mercury or red precipitate, consisting of one of mercury and two of oxygen.

How is the protoxide formed?—The protoxide is formed by di-

gesting protochloride of mercury or calomel in an alkaline solution; by which means a chloride of the alkali is formed, and protoxide of mercury is precipitated in the form of *blash wash.*

What are the properties of the protoxide? — It is a black powder, which is converted, by exposure to light or heat, into binoxide and metallic mercury; is insoluble in water, and is precipitated from its salts by the alkalies.

How is the binoxide or peroxide of mercury formed? — By long exposure to a heat sufficient to cause gentle ebullition, allowing the access of air.

What are its properties? — When in the form of scales it is bright red, but, when powdered, is of an orange or yellow colour; is slightly soluble in water; and forms, with ammonia, a fulminating compound.

What are the most important salts of mercury? — The nitrate; formed by the action of nitric acid upon mercury; the subsulphate, or *turpeth mineral,* or yellow sulphate of mercury, consisting of four proportions of the binoxide of mercury and three of sulphuric acid; formed by throwing the bipersulphate, or bisulphate of the peroxide or binoxide into hot water; and the bipersulphate, formed by mixing mercury, sulphuric and nitric acids, and evaporating to dryness; the nitric acid furnishing the oxygen. We have also the iodide.

What compounds does mercury form with chlorine? — Protochloride of mercury or calomel, consisting of one proportion of mercury, and one of chlorine; and bichloride or deutochloride of mercury, or *corrosive sublimate,* consisting of one proportion of mercury and two of chlorine.

How is the protochloride of mercury obtained? — By mixing the nitrate of the protoxide of mercury in solution with chlorohydric acid, or a soluble chloride; or by mixing protosulphate of mercury and chloride of sodium, and subliming; by which means the chlorine and mercury are sublimed together in the form of protochloride of mercury, while the oxygen and sulphuric acid previously united with the mercury, now unite with the sodium to form sulphate of soda.

What are the chemical properties of the protochloride? — It is a solid, of a white colour, tasteless, inodorous, insoluble; not altered by exposure to air, if it be kept from the light, and is decomposed by the alkalies and alkaline earths, and their carbonates, by soaps and by sulphydric acid.

How is the bichloride formed? — By heating mercury in chlorine until it ignites; or by mixing bisulphate of the peroxide of mercury with chloride of sodium (or common salt), in the proportion of one of the bipersulphate to two of the chloride; when, by the action of heat, the two proportions of sodium give up their chlorine to the single proportion of mercury, which is sublimed as the bichloride of mercury, while the two proportions of oxygen from the single proportion of peroxide of mercury combine with the two proportions of so-

dium to form two proportions of soda, with which the two proportions of sulphuric acid unite to form two proportions of sulphate of soda.

What are the properties of the bichloride of mercury? — It is a semitransparent, crystalline solid, of an acrid burning taste; is soluble in water, alcohol, and ether; is poisonous in its effects; forms, with muriate of ammonia, a soluble double salt called *sal alembroth;* is decomposed by albumen and gluten, which convert it into calomel; is decomposed by ammonia, which throws down white percipitate, consisting of ammonia, binoxide, and bichloride of mercury; is decomposed by alkalies, which, when in excess, throw down a yellow hydrated binoxide, and, when deficient, a brick-red precipitate, composed of bichloride and binoxide of mercury; is also decomposed by sulphydric acid, which throws down black sulphide (or sulphuret) of mercury.

What is Ethiops' mineral? — A mixture of the bisulphide of mercury with sulphur, which is formed by rubbing mercury and sulphur together, and is called by the Pharmacopœia, hydrargyri sulphuretum nigrum.

What is artificial cinnabar? — A bisulphate of mercury, formed by melting one proportion of sulphur, and gradually adding from five to seven of mercury, and then subliming.

What are its properties? — It is crystalline, and fibrous in its texture; insoluble in water and in alcohol; of a deep red colour; when powdered it is of a brilliant red, and forms the pigment called vermillion; is decomposed by heat; is also decomposed by nitro-muriatic acid, forming chloride of sulphur and bichloride of mercury; but is not acted on by nitric, muriatic, or sulphuric acids.

What are the combinations of mercury with other metals called? — Amalgams.

COPPER.

How is copper obtained?—It is obtained principally from the native sulphide, by volatilizing the sulphur by means of heat; and, as the metal is oxidized by this process, the oxide must be decomposed by heat and charcoal.

What are the properties of copper? — It is a malleable, ductile, elastic, and very tenacious metal, of a red colour; fuses at a white heat; is not tarnished by exposure to air, unless moisture be present, when its surface is converted into a carbonate of the black oxide; it is acted upon with difficulty by sulphuric and chlorohydric acids; but is violently acted upon by nitric acid; its specific gravity is 8·895, its symbol Cu (from *cuprum*), and its equivalent is 32, or, accurately, 31·6.

What are the more important alloys of copper? — *Bronze*, consisting of copper and tin; *bell-metal*, consisting of copper, with a larger proportion of tin than exists in bronze; and *brass*, consisting of copper and zinc

What are the tests for copper?—Polished iron or steel, upon which

copper is precipitated from its solutions; ammonia in excess, which produces a blue colour, arising from ammoniated copper; cyanoferrite, or ferrocyanuret, or ferrocyanide of potassium, which precipitates a reddish-brown cyanoferrite of copper; and albumen, which throws down a yellowish-white precipitate.

What compounds does copper form with oxygen? — The di or dinoxide, consisting of two proportions of copper and one of oxygen, forming spontaneously upon the surface of copper which has been exposed to air and moisture, and is of a dull red colour; the protoxide, consisting of equal proportions of copper and oxygen, is of a brownish-black colour, and is formed by heating copper to redness in contact with air; and the superoxide, consisting of one proportion of copper and two of oxygen, formed by mixing deutoxide of hydrogen (oxygenated water) with a weak solution of nitrate of copper, decomposing the nitrate by an alkali, washing the precipitate, which is of a browish-yellow colour, and drying it in the vacuum of an air-pump.

What is the most important salt of copper? — Sulphate of copper or blue *vitriol*, formed by boiling sulphuric acid upon copper.

What is ammoniated copper? — A compound formed by rubbing together sulphate of copper and carbonate of ammonia; it is of a deep blue colour, and consists of ammoniacal sulphate, and ammoniacal carbonate of copper.

What is the verdigris of commerce? — A mixture of the neutral acetate and the subacetate of copper.

What name has been given to the crystals of the neutral acetate of copper?—Crystals of Venus, or distilled verdigris.

LEAD.

From what source and in what way is lead obtained? — It is obtained principally from a native sulphide (or sulphuret) called Galena; by exposing the ore to heat and air in a reverberatory furnace; by which means the sulphur is converted into sulphurous acid, which escapes; while a part of the lead is obtained pure, and a part of it in combination with oxygen, from which it may be separated by heating it in contact with charcoal.

What are the properties of lead? — It is a solid, of a bluish-gray colour; and when cut, has a brilliant metallic lustre, which is soon dulled by a coating of carbonate of protoxide of lead, which forms upon its surface, owing to the carbonic acid of the atmosphere; it is very malleable and ductile, but not very tenacious; fuses at 600°, is dissolved by nitric and oxidized by boiling sulphuric acids; and is precipitated from its solutions by sulphydric acid or sulphuretted hydrogen.

Give its symbol, specific gravity, and chemical equivalent. — Its symbol is Pb, (from *plumbum*); its specific gravity, 11·352; its equivalent is 104, or, more accurately, 103·6.

What are the combinations of lead with oxygen? — Dinoxide,

obtained by decomposing oxalate of lead by heat, is of a gray colour, and consists of two proportions of lead and one of oxygen; protoxide, or *massicot*, obtained by collecting the dross from lead melted in open air, and exposing it to heat until it assumes a uniform yellow colour; it consists of one proportion of lead and two of oxygen; binoxide, consisting of one proportion of lead and one of oxygen; and red oxide or *minium*, consisting of three proportions of lead and four of oxygen, formed by heating the protoxide nearly to redness, and allowing it gradually to cool; by which means three proportions of the protoxide take an additional proportion of oxygen; and from this the binoxide is formed by the action of nitric acid, by which the minium is decomposed into protoxide and binoxide, the former of which unites with the nitric acid to form nitrate of lead.[1]

What is litharge?—It is a mixture of the protoxide with a very small proportion of red oxide; and is formed by partially melting the protoxide.

What are the only important salts of lead?—The carbonate, or *white lead*, and the acetate, or *sugar of lead.*

What characterizes the salts of lead?—They are precipitated by sulphydric acid, and by all the soluble salts of other metals, except those formed by nitric or acetic acids.

To what are the poisonous effects produced by water conveyed through leaden tubes, to be attributed?—To the formation of a carbonate of the protoxide, which is slightly soluble in water that does not contain any salt in solution.

What is plumbum corneum?—A solid resembling horn; formed by melting the chloride of lead.

TIN.

How is tin usually obtained, and what are its properties?—It is usually obtained from the native oxide by the action of heat and charcoal, and is a very malleable and ductile solid, of a lustre resembling silver; is flexible, but inelastic, emitting a crackling noise when bent; is not oxidized by exposure to air or moisture; is oxidized with violence, but not dissolved, by nitric acid; melts at 442°; and when heated to whiteness, takes fire and is converted into a peroxide.

Give its symbol, specific gravity, and chemical equivalent.—Its symbol is Sn, (from *stannum*); its specific gravity 7·9; its equivalent, 59; or, accurately, 58·9.

[1] The red oxide or minium, consisting of three proportions of lead and four of oxygen, is equivalent in composition to two proportions of the protoxide (each proportion consisting of one of lead and one of oxygen), and one proportion of binoxide, consisting of one of lead and two of oxygen; thus—

$$\begin{array}{r} \text{2 of protoxide} = Pb_2 + O^2 \\ \text{1 of binoxide} = Pb^1 + O_2 \\ \hline = \text{1 of red oxide} = Pb^3 + O_4 \end{array}$$

What is the fuming liquid of Libavius? — A liquid bichloride of tin, emitting dense suffocating fumes.

What are the only other remarkable compounds containing tin? — The bisulphide, or mosaic gold (*aurum musivum*), sometimes applied to the cushions of electric machines to increase their exciting power; and the protoxide and sesquioxide of tin, used as tests of gold; precipitating the purple of Cassius, the mixture of the peroxide of which is tin, and protoxide of gold.

BISMUTH.

How is bismuth obtained? — It is obtained by fusion from its ores, in which it exists native; and is purified by dissolving it in nitric acid, precipitating it in the form of subnitrate, by mixing it with water; and, finally, reducing it by heat and charcoal.

What are the properties of bismuth? — It is a solid, of a reddish-white colour, and considerable lustre; is crystalline; brittle when cold, but malleable when heated; is not oxidized by air without moisture or heat; fuses at 476°, and at a higher temperature is vaporized, and burns with a bluish-white flame; is acted on with difficulty by sulphuric or chlorohydric acids, but is violently oxidized and converted into a nitrate by nitric acid.

Give its symbol, specific gravity, and chemical equivalent. — Its symbol is Bi; its specific gravity, 9·82; its equivalent 71.

What is the subnitrate of bismuth?—It is a white powder, tasteless, and slightly soluble in water; called, also, white oxide, or *magistery of bismuth;* formed by throwing the nitrate into water; and consisting of oxide of bismuth, combined with a small proportion of nitric acid.

What is the composition of fusible metal? — Eight parts of bismuth, five parts of lead, and three of tin; it melts below 212°, hence the name.

IRON.

How does iron exist in nature? — In the form of oxides, or sulphides; and is sometimes found native in æreolites, or minerals of meteoric origin.

What peculiar property resides in some of its ores? — The magnetic property.

How is it usually obtained? — By heating its ores with charcoal and lime; which latter combines with the impurities of the ore, and forms a glass or *slag,* through which the melted iron sinks and is drawn off.

What are the properties of iron? — It is of a well-known colour; has considerable lustre when polished; is easily oxidized by moist air; is very hard and tenacious; is very malleable and ductile, especially when heated; is hardened by being heated and suddenly cooled; is fused with difficulty; is capable of being welded; and is acted upon with difficulty by pure acids.

Give its symbol, specific gravity, and chemical equivalent?—Its symbol is Fe (from *ferrum*); its specific gravity, 7·788; and its equivalent 28.

What are the compounds of iron with oxygen?—Protoxide, obtained by precipitation from the sulphate of the protoxide, or green vitriol, consisting of iron and oxygen, each one equivalent; per sesqui, or red oxide, or colcothar, found native in hæmatite (or formed by heating the sulphate), consisting of two equivalents of iron and four of oxygen; and black or magnetic oxide, formed by exposing iron at a red heat to steam, and consisting of three of iron and four of oxygen, or of a mixture of equal parts of the protoxide and peroxide.

What are the peculiar characteristics of the protoxide?—The protoxide is of a blue colour; is converted into peroxide, when exposed to air, by absorbing oxygen; is not changed in colour by nutgalls; but is precipitated in the form of a black sulphide of iron, by the alkaline sulphydrates, as a white hydrate by the alkaline carbonates, and a white cyanoferrite by cyanoferrite of potassium.

What are the properties of the peroxide?—It is of a dull red colour; forms, with the acids, salts of a red colour; is precipitated from its solutions by the alkalies and alkaline carbonates; forms Prussian blue, with cyanoferrite (ferrocyanuret) of potassium; and forms with sulphocyanhydric, or with meconic acid, a red, and with infusion of galls, a dark blue colour.

What are some other important compounds of iron?—The protiodide, which is used in medicine; the sulphide or sulphuret of iron pyrites, which is found native; and the compounds of iron with carbon, in the form of cast iron and steel.

What are the most important salts of the oxide of iron?—The sulphate of iron or green vitriol, the carbonate, the tartrate, the acetate, the muriate or chlorohydrate, and the phosphate; all of which are used principally in medicine.

ZINC.

How is zinc usually obtained?—It is procured from *calamine*, or the native carbonate; or from *blende*, or the native sulphide, by heating it with charcoal.

What are its properties?—It is a metal resembling lead in colour; is slightly crystalline in structure; malleable at a temperatare of between 210° and 300° of Fahrenheit, but brittle at high or low temperatures; melts at 680°, according to some chemists, and at 773°, according to others; crystallizes when allowed to cool after fusion; is sublimed at a very high temperature; is slightly oxidized by exposure to air and moisture; but at a high heat, exposed to the atmosphere, is oxidized and volatilized with combustion; it decomposes the water in dilute sulphuric or chlorohydric acids; and takes from one portion

of nitric acid its oxygen to form an oxide, with which the rest of the acid combines to form a nitrate.

Give its commercial name, its symbol, specific gravity, and chemical equivalent?—It is sometimes called *spelter*, in commerce; its symbol is Zn; its specific gravity, 6·86; its equivalent, 32·3.

What are the principal compounds of zinc with oxygen and chlorine?—Protoxide of zinc, otherwise called *flowers of zinc*, *nihil album*, and *lava philosophica*, a light fleecy substance of a white colour, formed by the combustion of zinc, or by precipitation from the sulphate by liquid ammonia, and consisting of zinc and oxygen, each one proportion; and chloride of zinc, called also *butter of zinc*, formed by burning zinc in chlorine, and consisting of one proportion of zinc and one of chlorine.

What are the only important salts of zinc?—The acetate and the sulphate of zinc, or *white vitriol.*

What is a test for detecting the presence of zinc?—Pure potassa or ammonia, which throw down a white precipitate, which is redissolved by adding the alkali in excess.

ARSENIC.

How is arsenic obtained?—It is obtained from an ore, called in commerce *cobalt* (consisting of arsenic in the form of an oxide, combined with cobalt), by distillation.

What are its properties?—It is excessively brittle; of a colour and lustre resembling steel; burns with an odour resembling garlic, at 356°, and cannot be melted without a pressure exceeding that of the atmosphere; if volatilized in the open air, is converted into an oxide; is tarnished by partial oxidation when exposed to air and moisture, and is slowly oxidized and dissolved by being boiled in water.

What are the most important compounds of arsenic with other substances?—Arsenious and arsenic acids, and arseniuretted hydrogen.

Give the composition and properties of arsenious acid?—It is formed by igniting arsenic in the air, consists of two proportions or equivalents of arsenic and three of oxygen; it is of a white colour, whence it has been called *white arsenic*, or *white oxide of arsenic;* has a taste at first slightly acid, then sweetish; reddens vegetable colours; slightly soluble in water; when heated in open vessels, sublimes at 380°, but, if in close vessels, fuses, becomes opaque, more soluble in boiling water, and has an alkaline reaction with vegetable colours; when digested with nitro-muriatic or strong nitric acid, and the solution evaporated, it takes two additional proportions of oxygen, and is changed into arsenic acid; it is a virulent poison, and is the form in which arsenic is usually employed for that purpose.

Describe the formation and properties of arsenic acid.—It is formed by digesting arsenious acid in nitro-muriatic or strong nitric

acid, and then expelling the nitric acid by heat; consists of two proportions of arsenic and five of oxygen; is a white solid; acts as a caustic upon animal fibre; reddens vegetable blues; is more soluble than arsenious acid; is deliquescent; is first melted into a glass, and afterwards decomposed into arsenious acid and oxygen by heat; is poisonous; and is more virulent and energetic in its properties than arsenious acid.

What is Fowler's solution?—An arsenite of potassa, formed by boiling together arsenious acid and carbonate of potassa in distilled water.

What is arseniuretted hydrogen?—It consists of arsenic and hydrogen, in the proportion of two or three; may be obtained by adding arsenic to the materials for generating hydrogen (see *Hare's Compendium*, p. 187); is an inflammable gas, burning with a bluish white flame, with the odour of arsenic; and is fatal to life, though destitute of acid qualities.

What are the other important compounds of arsenic?—The sesquichloride, which resembles the *fuming liquor of Libavius;* the protosulphide, or *realgar*, which is of a red colour; and the sesquisulphide, called also *orpiment*, forming the colouring matter of *king's yellow*.

Give the symbol, specific gravity, and chemical equivalent of arsenic?—Its symbol is As; its specific gravity, 5·8843; its chemical equivalent, 37·7.

What are the ordinary tests for detecting the presence of arsenic? Sulphydric acid, which precipitates from arsenious acid, the yellow sesquisulphide or orpiment, and from arsenic acid, a yellow precipitate resembling orpiment, but containing more sulphur; ammoniacal nitrate of silver, which precipitates from solutions containing arsenious acids, the yellow arsenite of silver, and from arsenic acid, the brick-red arseniate; ammoniacal nitrate of copper, which precipitates from arsenious acid, a green arsenite of copper, called *Scheele's green;* but the most accurate method is to put the suspected material into the self-generating reservoir (see *Hare's Compendium*, p. 187), together with the materials for generating hydrogen, and upon inflaming the jet of arseniuretted hydrogen thus produced, and holding a cool porcelain plate over the flame, a *tache* or ring of metallic arsenic will be condensed upon the plate.

What process is necessary to detect arsenic where organic matter is present, as in cases of poisoning?—The stomach, intestines, &c., supposed to contain arsenic together with their contents, must be thrown into water, evaporated at a moderate heat, and, when dry, treated with strong nitric acid, which carbonizes and reduces the bulk of the mass, and converts the arsenic, if it be in the form of arsenious acid, into the more soluble and less volatile arsenic acid; then, on digesting the whole in water, the arsenic acid may be precipitated as arseniate of lime, by adding lime-water; the arseniate of lime should then be

dried, mixed with one-fourth its weight in charcoal, and placed in the sealed extremity of a long and narrow tube, whose other extremity is open; care should be taken to wipe the tube dry by means of cotton-wick wound upon a wire; heat is then applied to the tube, beginning at the open and proceeding toward the sealed extremity, and the resulting moisture carefully removed by the cotton-wick; the heat is then reapplied to the sealed extremity, and carried as high as the tube will bear without melting, when the arsenic will be deposited in minute crystals, at the part of the tube beyond the part that was heated, forming the arsenical ring.

ANTIMONY.

How is antimony obtained?—It is obtained from the native sulphide (anciently called *stibium*, which is the antimony of commerce), by mixing it with bitartrate of potassa and nitrate of potassa, and throwing the mixture into a red-hot crucible.

What is the *rationale* of this process?—The oxygen of the nitrate converts the sulphur into sulphurous acid; the carbon of the tartaric acid unites with the oxygen; while the potassa acts as a flux in promoting the fusion of the antimony, which subsides to the bottom of the crucible.

What further process is necessary?—It must be purified by dissolving it in nitro-muriatic acid; precipitating it in the state of oxychloride, by throwing it into water; and reducing it again, by ignition with bitartrate of potassa.

Give the commercial name and chemical properties of antimony.—Metallic antimony is called, in commerce, *regulus of antimony;* it is of a silvery colour; is very brittle; emits an odour when rubbed; fuses at 810°; is not sublimed at a white heat in close vessels; but in the open air it takes fire at a white heat and burns with a white light, condensing in minute crystals of the sesquioxide, called *argentine flowers of antimony;* boiling sulphuric acid and nitric acid are partially decomposed by antimony, which forms thus an oxide, with which the remaining acid combines.

Give the symbol, specific gravity, and equivalent number of antimony.—Its symbol is Sb, (from *stibium*); its specific gravity, 6·7; its equivalent number, 64·6.

What is the test for antimony?—Sulphydric acid, which precipitates Kerme's mineral, which is known by its orange-yellow colour.

What are the most important compounds of antimony?—The sesquioxide, consisting of two equivalents of antimony and three of chlorine, formed by throwing the sesquichloride into water, which precipitates the oxychloride of antimony or *powder of Algaroth*, which, by digestion with carbonate of potassa, yields the sesquioxide; and the sesquichloride, or *butter of antimony*, consisting of two equivalents of antimony and three of chlorine, formed by burning antimony in chlorine gas, or by distilling a mixture of antimony and corrosive sublimate.

What are the compounds known as red antimony, glass, liver, crocus of antimony?—Compounds of oxide and sulphide of antimony.

What are *Kermé's mineral* and *golden sulphur* of antimony?—Substances whose composition are somewhat uncertain, probably consisting of hydrated sesquisulphide and sesquioxide of antimony.

What are the metals proper of minor importance?—Palladium, rhodium, iridium, osmium, nickel, cadmium, chromium, cobalt, manganese, molybdinum, titanium, tungsten, uranium, cerium, vanadium, and there has lately been discovered two others, pelopium and niobium; to these may be added ruthenium, recently obtained from platinum residues.

OXYSALTS, &C.

Which is the most numerous and important class of salts?—The *oxysalts*, or those whose acids contain oxygen as their electro-negative.

What are the peculiar properties of the nitrates?—They deflagrate with charcoal, sulphuric, and other combustibles, with which their oxygen combines to form carbonic acid, sulphuric acid, &c.; when added to liquid chlorohydric acid, they free the chlorine and enable it to dissolve gold; when dry, they emit nitric acid fumes, if subjected to concentrated sulphuric acid; and such of them as are neutral are soluble, and, generally, deliquescent.

What are the distinguishing characters of the sulphates?—They are precipitated from their solutions by baryta; yield their oxygen, when heated with charcoal or hydrogen, being converted into sulphides or sulphurets; and are almost all of them insoluble in alcohol.

What are the distinguishing qualities of the carbonates?—They are decomposed by almost all the acids, yielding carbonic acid with effervescence; are decomposed, also, by heat, except the carbonates of the proper alkalies, and of barium and strontium; and all the carbonates except those of soda, potassa, and ammonia, are sparingly soluble in water.

What is meant by hydro-salts?—Those whose acid or base contains hydrogen.

What are the only hydro-salts now recognised?—Those of the compounds of ammonia with a hydracid, as the hydrochlorate or the hydrosulphate.

What are sulphur salts?—They are double sulphurets; the sulphuret of one metal acting as an acid, and that of another as a base.

What are double haloid salts?—Two simple haloid salts; one of which acts as an acid, and the other as a base.

ORGANIC CHEMISTRY.

What are meant by organic substances? — Definite chemical compounds, found ready formed in organized beings, and their modifications produced by artificial processes, which may be greatly varied.

What do you mean by organic chemistry? — That department of chemistry, which investigates the phenomena and results of organic life, and examines the chemical relations of plants and animals, and the properties and transformations of the bodies they present.

What are the elements which usually enter into organic substances? — Carbon, hydrogen, oxygen, and nitrogen.

What organic substances contain only carbon and hydrogen? — Olefiant gas, and other hydro-carbons.

What more frequently contain carbon, hydrogen, and oxygen? — Sugar, gum, many neutral bodies, and most organic acids.

In what class does nitrogen form an important part? — The vegetable alkalies, and various compounds which belong more usually to the animal division.

What is one of the most striking features in organic chemistry? — The almost constant occurrence of isomeric bodies.

What are the artificial processes which modify the production of organic compounds?—By means of the hydrate of potash, distillation by heat, acids, oxygen, chlorine, &c.

What is meant by the term eremacauses? — The slow combustion or oxidation of organic matters in air.

What fact has had great weight in investigating the subject of organic compounds? — That chlorine frequently takes the place of hydrogen, and that a compound may preserve its leading chemical characters, although this change may have taken place.

ORGANIC CHEMISTRY OF VEGETABLES.

What is meant by the proximate and ultimate principles of vegetables?—Every distinct compound (as sugar, starch, morphia, quinia, &c.), existing already formed in a vegetable, is called a proximate principle; its ultimate principles are those simple elements (as carbon, hydrogen, &c.), beyond which analysis cannot be carried.

What particular elements or ultimate principles exist in almost every vegetable substance?—Carbon, hydrogen, and oxygen; although oxygen is absent from some vegetable substances (as the essential oils, caoutchouc, &c.; and hydrogen from others (as in oxalic acid, &c.).

What other ultimate principles are found in vegetables? — The vegetable alkaloids (morphia, quinia, brucia, strychnia, &c.), contain nitrogen; and magnesium, calcium, potassium, sodium, silicon, &c., are found to exist in minute quantity, in very many vegetable products.

What effect is produced upon vegetable substances by heat?—They first yield the water and essential oils existing in them; at a higher heat, pyroligneous acid, carbonic oxide, and compounds of carbon and hydrogen; if nitrogen be present, it unites with hydrogen to form ammonia; and if heat and pressure be employed together, the vegetable matter is converted into a species of bitumen, resembling that of coal; but if burned in the open air, water and carbonic acid are the only products.

What substances often occur in small quantities?—Sulphur, phosphorus, and iron; these, when decomposed and transformed by reagents, give rise to a large number of compounds, which, in connection with hydrogen, carbon, oxygen, and nitrogen, have often united with them sulphur, phosphorus, chlorine, bromine, iodine, arsenic, antimony, and the metals.

What two classes enter into the structure of living beings?—Organized substances, such as muscular fibre, cellular and vascular tissues, &c.; secondly, those produced by the destruction of organized bodies, or the secretions or excretions of organized beings, or which may be formed artificially, as the alcohols, oils, acids, resins, sugars, &c.

What is the effect of chemical agencies upon organized bodies?—To disorganize them.

What is the effect of heat upon organized bodies?—They are decomposed into a variety of products, some of which are water, carbonic acid gas, carburets of hydrogen, and, if nitrogen is present, ammonia.

Are not the salts of potash, lime, soda, magnesia, iron, together with the sulphuric, phosphoric, and silicic acids, chlorine and fluorine, present in animals and vegetables?—Yes.

What are the two laws of particular importance in this branch of of chemistry?—That of *equivalent substitution* and *direct union*.

What is meant by the first of these?—That where one or more atoms of an element or compound may be replaced by any other element or group of elements, which are equivalent in their chemical relations, and the chemical constitution of the compound remain unchanged, it is reducible to the law of double elective affinity.

What is meant by the law of *direct union?*—Where we have only one product by *direct union*, as where ammonia may combine with an acid, as with hydrochloric acid, to form *sal ammoniac*, &c.; also when a body may eliminate the elements of water, or hydrogen, &c., and resolve itself into two, as, for instance, where alcohol, $O_4H_6O_2$, under reagents may lose H_2, and, in some of its combinations, is resolved into C_4H_4 and H_2O_2 by heat.

Is not the law of combinations by volumes of importance in this branch of chemistry?—Yes.—[See *Chem.*]

Give the formula for estimating the density of carbon vapour.—Carbon not being obtainable in the gaseous form, we take one of its

compounds; when carbon is burned in oxygen gas, it is converted into carbonic acid without change of volume; now if we subtract from the weight of the new compound that of the oxygen, we then have the weight of carbon vapour; hence we judge that, by having the composition and equivalent of a body given, we can calculate its density, or the reverse.

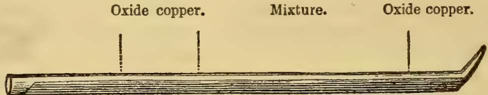
What is understood by the law of divisibility of formulas?—That in all compounds of carbon, hydrogen, and oxygen, represented by an equivalent of four volumes of vapour, the number of atoms of carbon and oxygen are always divisible by two, and that of the atoms of hydrogen by the same number; if the oxygen is wholly or in part replaced by sulphur or selenium, the substitution is atom for atom; and if hydrogen is replaced in whole or in part by chlorine, iodine, bromine, by nitrogen, phosphorus, arsenic, or antimony, or any of the metals, the sum of the number of the atoms will always be a multiple of two.

What is meant by chemical homologues?—A series of analogous substances, whose composition varies by C_2H_2, or a multiple of it; this law is of great importance in organic chemistry.

Upon what principle does the analysis of organic bodies depend?—That all organic bodies undergo decomposition when exposed to a high heat in the presence of oxygen, and that the weight of carbonic acid and water, which results from the union of oxygen with the carbon and hydrogen of the organic body, indicates the relative proportions of carbon and hydrogen.

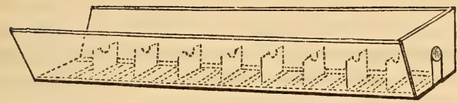
Give a general outline of the process of Liebig to effect this.—He uses the black oxide of copper, which, unchanged by heat, alone gives up oxygen to combustible matter with great facility. The substance to be examined must be physically pure and freed from moisture; the protoxide of copper is made from the nitrate by heat, and is reduced to powder, and re-heated to expel all moisture; the combustion is performed in a Bohemian glass tube, of a diameter 0·4, or 0·5 in., and in length from 14 to 18 inches; the one end of the tube is drawn out, as shown in Fig. 280, and closed; the other is simply fused, to soften

Fig. 280.



the edges of the glass. The tube is now filled two-thirds with the warm protoxide of copper; the organic substance, mixed with the remaining protoxide in a wedgewood mortar, is transferred to the tube; the tube is gently rinsed with fresh hot oxide, and filled with the remaining oxide from the crucible; the whole is gently shaken together; the tube is then placed in a furnace of sheet-iron (Fig. 281), which is placed upon bricks, and raised or depressed,

Fig. 281.



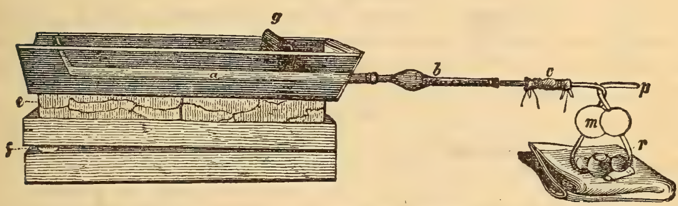
as more or less air is required; a slight inclination is given to the furnace at the end where the orifice of the combustion-tube passes out. To collect the water produced by the experiment, a small tube (Fig. 282), filled with fragments of spongy chloride of calcium, is attached by a perforated cork, well dried, to the end of the combustion tube; the carbonic acid is condensed in a solution of caustic potash, sp. gr. 1·27, contained in a small apparatus (Fig. 283) called Liebig's potash

Fig. 282.

Fig. 283.

bulb-tube; the connection between this tube and the chloride of calcium is made by a small tube of caoutchouc; the whole apparatus is seen (Fig. 284). Before experimenting, the calcium-tube and the

Fig. 284.



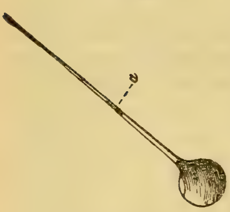
potash bulb-tube are accurately weighed; the tightness of the junction of the tubing must be perfect; red-hot charcoal is now applied to the anterior portion of the combustion-tube containing the pure oxide of copper, and gradually moved to the other end by the screen *g*. A uniform stream of carbonic acid should enter the potash bulb, the bubbles of which can be counted; if no nitrogen is present, these bubbles, near the close of the experiment, are almost entirely absorbed by the potash solution; if, however, on the contrary, nitrogen is pre-

sent, the bubbles will constantly escape through the potash solution. When the tube has been heated from one end to the other, and no more gas disengaged, but absorption begins, the coals are removed from the further extremity of the combustion tube, and its point broken off; a little air is drawn through the apparatus, by which the remaining carbonic acid and watery vapour is secured; the parts of the apparatus are detached, and the chloride of calcium tube and potash tube are weighed; from the increase of weight in the chloride of calcium tube the amount of water and thence that of hydrogen is deduced; and from the increase of weight in the potash bulb-tube the amount of carbon is determined.

Give a general example of calculating, by experiment, the product of an organic analysis? — Suppose sugar the article to be analyzed. Take a certain amount of sugar, weigh the potash bulb-tube before experiment, and then again after experiment, and subtract the weights so obtained, and we have the amount of carbonic acid. Weigh the chloride of calcium, both before and after experimenting, as before done, and we obtain the weight of water.

How are volatile liquids analyzed? — By enclosing them in a narrow-neck bulb of thin glass. The bulb is previously weighed, and the liquid introduced, and the bulb sealed, and again weighed, which gives the weight of the liquid. The neck of the bulb is broken off (Fig. 285), dropped into the combustion-tube, and covered with the oxide of copper. This is heated to redness, and a gentle heat applied to the end of the combustion-tube containing the volatile liquid, its vapour is sent over the ignited oxide, completely burning it, and its products are calculated as before.

Fig. 285.



When substances which contain a large proportion of carbon and little hydrogen are to be examined, what article is preferable to the oxide of copper? — Chromate of lead.

How are azotized substances, or those containing nitrogen analyzed? — By placing in one end of the combustion-tube three inches of carbonate of copper, secured by a plug of asbestos; and now introduce the substance to be analyzed, mixed with the oxide of copper, and fill the remainder of the combustion-tube with copper turnings; withdraw the air by an air-pump, heat the carbonate of copper in the tube to expel the remainder of the air. Now heat the tube as usual, and collect the gases evolved in a graduated air-jar over mercury. After having finished the combustion, again apply heat to the carbonate of copper, and another portion of carbonic acid is expelled, which drives out all the nitrogen. The carbonic acid is removed from the air-jar by washing with a strong solution of potash, and pure nitrogen remains, which is carefully measured; and by ascertaining

its volume, the weight is determined. In addition to the above porcess, others have been used, and especially that of Will and Varrentrapp, which is excellent.

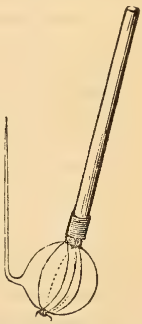
How is chlorine determined in any organic body by analysis?—By passing the vapour over quick-lime, heated to redness in a combustion-tube, by which chloride of calcium is formed; which is afterwards dissolved in water, and the chloride precipitated by nitrate of silver; and from the weight of the chloride of silver the amount of chloride is calculated.

How is sulphur determined by analysis?—By fusion with nitre and carbonate of soda, or by digestion with nitric acid. Sulphuric acid is thus formed and precipitated by barytes, as sulphate of baryta, from the weight of which that of sulphur is determined. When oxide of copper is used in this experiment, peroxide or chromate of lead must be placed between the chloride of calcium and potash tubes, to absorb the sulphurous acid.

DENSITY OF VAPOURS.

How would you determine the density of the vapour of a volatile substance?—A light glass globe, as represented (Fig. 286), is taken, and the substance put into it—the weight of which has been ascertained. It is then held by a handle attached to it beneath the surface of a water-bath, and heated above the boiling point of the substance to be analyzed. By this means the substance is volatilized, and the open and projecting end of the globe's neck is sealed by a blow-pipe, and the temperature of the bath noted. The globe is now cooled, and again weighed, and the end broken off beneath a surface of mercury, which rushes up and fills the empty vessel; the mercury is carefully measured. The capacity of the vessel and its weight being known, we can find the weight of a volume of vapour at the observed temperature, and calculate what would be its weight at the ordinary temperature; and its weight compared with that of the same volume of air gives the specific gravity or density.

Fig. 286.



EMPIRICAL AND RATIONAL FORMULÆ.

What do you understand by these?—By the empirical, we mean the simplest possible expression of the composition of the substance to which it refers. By the rational, we understand one which describes the exact composition of one equivalent, or combining proportion of the substance; by stating the absolute numbers of equivalents of each of the elements essential to that object, as well as the mere relations existing between them. The rational formula may coincide with the empirical, or it may be a multiple of it.

NON-AZOTIZED SUBSTANCES OF THE SACCHARINE AND AMYLACEOUS GROUP.

SUGAR, STARCH, GUM, LIGNIN, &C.

What is peculiar to this group? — They present several cases of isomerism, and are characterized by their feeble aptitude to enter into combination, containing, with perhaps, one exception, oxygen and hydrogen in the proportion to form water. They are not volatile, and are decomposed by heat, and many other agents.

Whence is cane-sugar obtained, &c.?—It is composed of $C_{24}H_{22}O_{22}$, and is obtained from the juices of the sugar-cane, maple, beet-root, and Indian corn, by evaporating the juices to syrups, and crystallizing; and purified by redissolving — repurifying by animal charcoal; by recrystallization, it forms rock candy. It fuses at 356°, is soluble in one-third its weight of water, and is insoluble in pure alcohol.

What is the formula for grape-sugar, or glucose, and how is it obtained? — Formula, $C_{24}H_{24}O_{24} + 2H_2O_2$. It is found in the grape, and other fruits, and in honey. It is also formed by boiling cane-sugar or starch with sulphuric acid. It is the sugar found in the urine in diabetes mellitus. Grape-sugar is obtained as a white granular mass, requiring one and a half parts of cold water to dissolve it. It is not as sweet as cane-sugar. With sulphuric acid it forms a coupled acid, the sulpho-saccharic. With common salt it forms a beautiful crystalline mass. By mixing a solution of grape-sugar with a solution of potash, and then adding a little of the solution of sulphate of copper, and heating it, the liquid darkens, and soon deposits a red powder of suboxide of copper. This is the test used in diabetes mellitus, known as Trommer's It will detect $\frac{1}{10000}$ part of grape-sugar in a liquid. Honey is a mixture of crystallizable and uncrystallizable grape-sugar.

What is the formula of sugar of milk or lactose, or lactin, and how is it obtained? — Formula, $C_{24}H_{20}O_{20} + 2H_2O_2$. This is obtained from the whey of milk by evaporation, and purifying by animal charcoal and crystallizing. It forms four-sided prisms, white and translucent, and extremely hard. It has a feebly sweet taste. It requires from 5 to 6 times its weight of cold water to dissolve it, and from 2 to 3 of boiling water. At 212° its water is expelled. By boiling with sulphuric acid, dilute, it is converted into grape-sugar.

What is mannite or manna-sugar, what is its formula, and how obtained? — Formula, $C_{12}H_{14}O_{12}$. This is not properly a sugar, as it does not contain hydrogen and oxygen in the proportions to form water. It will not ferment. It is the chief component of *manna*, and in the juice of celery, and many sea-weeds. It is prepared by heating manna with boiling alcohol, and filtering while hot, when the mannite crystallizes, on cooling, in tufts of slender colourless crystals.

It fuses by heat without loss of weight, is very soluble in water, and of a very sweet taste. It combines with sulphuric acid, producing a new acid, and is acted on by concentrated nitric acid. Mushroom-sugar is merely mannite.

What is fecula or starch, its formula, and how obtained?—Formula, $C_{24}H_{20}O_{20}$. It exists in a great variety of vegetables, and is found in all the cereal grains, and the roots and tubers of plants, as the potato, and also in the bark and pith of various trees, and in various seeds. It is obtained by grinding or rasping the substance containing it, and washing with cold water, which holds the starch in solution, and deposits it by standing. The gluten left behind in preparing starch from grain, contains a large amount of nitrogen, and upon this article the value of meal as an article of diet depends. Starch is insoluble in cold water and alcohol. To the naked eye, it appears as a white, soft, glistening powder, and by the microscope no crystallization is shown, but it is made up of granules, which vary in magnitude and form, as the plants from which they are derived. By heating starch and water to the boiling point, the granules burst and disappear, producing a gelatinous mass. It is precipitated by many metallic oxides. The best test is iodine, forming a deep indigo blue.

What is dextrin?—This is formed by mixing a solution of starch with an acid, or an infusion of malt; and, gently heated, becomes very fluid, and is soluble in cold water, and is not coloured blue by iodine. By heating starch to 300° or 400° it is rendered soluble in cold water, and possesses the properties of dextrin, and in this state it is sold as British gum. By boiling dextrin for a long time with dilute sulphuric acid, it is converted into grape-sugar. Starch or dextrin unites with sulphuric acid, forming a coupled acid. Dextrin has been so called, from twisting the plane of polarization towards the right hand.

What is malt, and what is its action upon sugar?—This is prepared from barley by moistening the grain with water, and exposing it to heat till it commences to germinate, when it is dried in an oven to vitiate its vitality. The grain now contains a portion of starch sugar, and a small portion of a substance called diastase, (from διίστημι, to separate, on account of its separating the insoluble envelopes of the starch globules), to which it owes its particular properties. It is precipitated by alcohol; by mixing a small portion of it with a mixture of starch and water, at a temperature of 130° to 140°, the starch is converted into dextrin, and afterwards into grape-sugar.

What is the formula for gum, and whence is it obtained?—Formula $C_{24}H_{20}O_{20}$. This is best shown by gum-arabic; and the gums from the cherry, plum, &c., and the mucilage of flax-seed, and other plants, are identical with it. It is soluble in water, and is precipitated unchanged by alcohol. By boiling with sulphuric acid it is converted into grape-sugar. With nitric acid, mucic acid, $C_{12}H_{10}O_{16}$,

is produced, and is mesameric with the saccharine acid, though different in properties.

What is pectin? — The jelly of fruits, and is closely allied to the preceding, and may be extracted from many vegetable juices, by alcohol. To this the consistence of currant, and other fruit jellies, are attributable. Its formula, according to Fremy, is $C_{64}H_{48}O_{64}$.

What is lignin and cellulose, or woody fibre, &c.? — This is the insoluble solid part of vegetables and plants, and remains when water, alcohol, ether, &c., have extracted from wood its soluble portions. This should not be confounded with *ligneous* or *woody tissue*, which is cellulose, in combination with other substances superadded, giving stiffness and inflexibility to the membranous cells. Pure cellulose is closely allied to, if not isomeric with, starch. The properties of lignin may be studied in fine linen or cotton; it is tasteless, innutritious, and insoluble in water and alcohol; boiling water has little effect upon it, unless derived from the young twigs of plants; dilute acids or alkalies affect it slightly, even at a boiling temperature; strong oil of vitriol, when cold, and kept cold, acts upon it, and converts it into an adhesive substance, resembling *dextrin*. By a delicate process it can be converted into grape-sugar. Lignin is not coloured by iodine.

THE EFFECT OF CHEMICAL AGENTS UPON THE PRECEDING SUBSTANCES, AND THEIR PRODUCTS.

ACTION OF NITRIC ACID.

Where does oxalic exist naturally, and how formed artificially, and what is its formula? — Formula, $C_2O_3HO + 2HO$. It is formed, in combination with potassa, in many vegetables, plants, &c., in the wood-sorrel, *oxalis acetosella*, &c. It is made for commerce by the action of nitric acid and heat upon sugar, starch, and dextrin. The crystals dissolve in 8 parts of water, at 60°, and in their own weight, or less, of hot water, and also in spirits. The aqueous solution is intensely sour, and highly poisonous; the antidote for its poisonous effects is chalk or magnesia. The test for it is lime, forming an insoluble oxalate.

What are the most important salts of oxalic acid?—Neutral oxalate of potassa, $KO, C_2O_3 + HO$; the binoxalate, $KO, 2C_2O_3 + 3HO$, also called salt of sorrel; the quadroxalate, $KO, 4C_2O_5 + 7HO$; the oxalate of soda, NaO,C_2O_3; the oxalate of ammonia, $NH_4C_2O_3 + HO$; oxalate of lime, $CaO,O_2C_2O_3 + 2HO$.

What is saccharic acid, its formula, &c.? — It was once thought to be identical with malic acid; it has, however, been found not so, but is formed during the action of nitric acid upon sugar, when forming oxalic acid, in the mother-liquid from which the oxalic acid has been crystallized.

What is xyloidin, and what is its formula?—Formula, $C_{24}H_{17}N_3O_{32}$. It is the product of the action of nitric acid; sp. gr. 1·5 upon starch,

producing a transparent, colourless jelly, which, when added to water, yields a white, curdy, insoluble substance, called as above.

What is pyroxylin, or gun-cotton, and its formula?—If finely-divided ligneous matter, as cotton-wool, is steeped in nitric acid, sp. gr. 1·5, and concentrated sulphuric acid; squeezed, and dried by a moderate temperature, the resulting substance, as above, will be found, highly explosive and burning without smoke or residue. It differs from the preceding in composition, mode of combustion, &c. The solution of *gun-cotton* in ether forms *collodion*, highly valued in surgery as an adhesive. The formula for pyroxylin is $C_{24}H_{15}N_5O_{40}$.

SUGAR FERMENTATION AND PRODUCTS.

What is meant by fermentation?—The peculiar change induced in complex organic matter, by a disturbance of its elements, through the agency of an external disturbing force, differing from ordinary chemical attraction, and dependent upon a principle similar to that of katalysis.

Upon what does vinous fermentation depend?—Upon the presence of putrescible azotized matter, in a proper state of decay, in any solution containing sugar, at a temperature of 70°, converting it into alcohol and carbonic acid gas, which escapes. The best ferment is *yeast*, or the insoluble, yellowish, viscid matter deposited from beer in the act of fermentation (a solution of *pure sugar* will not undergo this change). When effervescence ceases, alcohol is yielded by distillation.

What is the composition of alcohol?—$C_4H_6O_2$, and is produced by breaking up an equivalent of GRAPE-*sugar*, $C_{24}H_{28}O_{28}$, into 4 eq. of alcohol, 8 of carbonic acid, and 4 of water. Grape-sugar alone yields alcohol; the product of distillation is very weak; it is strengthened by subsequent distillation, but cannot be procured free of water, unless distilled with half its weight of fresh quicklime.

What are the characteristics of pure alcohol?—It is colourless and limpid, of a pungent, agreeable taste and odour; sp. gr. 0·7938 at 60°, and that of its vapour, 1·613; it is very inflammable, and is frozen with great difficulty; it is easily miscible with water, in all proportions; it is a great solvent.

To what do wine and beer owe their intoxicating properties?—To alcohol; the former is merely the expressed juice of the grape, set aside to ferment, which it does spontaneously. When coloured, it is owing to the skins of the grape; when wine is sweet, sugar is in excess, and the ferment deficient; when the sugar is small in proportion and the albumen or ferment in excess, we have what is called *dry* wine. Effervescent wines are bottled before fermentation has ceased. During the fermentation of grape-juice a hard substance, called *argol*, is produced, consisting of tartrate of potassa, and a little tartrate of lime, and colouring matter, from which the *tartaric acid* is formed. Beer is the liquor prepared from germinated grain, particularly *barley*, which is previously *malted*.

What is the *yeast* of beer? — The peculiar substance previously described, presenting, under the microscope, a kind of organized appearance, made up of transparent globules, and is formed from the soluble azotized portion of grain during fermentation. No yeast is produced in liquids free from azotized matter.

What occurs when bread is made? — The vinous fermentation operates; the yeast added to the dough converts the sugar it contains into alcohol and carbonic acid gas; the gas disengaged forces the tough materials of the dough into bubbles, which are still further expanded by the heat of the oven, which drives off, at the same time, the alcohol.

PRODUCTS OF THE ACTION OF ACIDS ON ALCOHOL.

What is produced by heating any strong acid with alcohol? — An ether.

What is the basis of all the alcohol series of ethers? — The radical ethyl, which has recently been isolated; its formula is C_4H_5O.

What is the oxide of ethyl, or ether? — The product of distillation of alcohol and sulphuric acid, commonly called *sulphuric ether.*

What are the properties of pure ether? — It is a colourless, transparent, fragrant liquid, sp. gr. 0·720 at 60°, and boils at 96° under the pressure of the atmosphere, and has never been frozen. It is highly combustible, burning with a white flame, generating water and carbonic acid. Though itself very light, its vapour is very heavy; mixed with oxygen gas, it explodes when fired; it readily absorbs oxygen from the air and becomes acid; it is decomposed by transmission through a red-hot tube with olefiant gas, light carburetted hydrogen, and *aldehyde* disengaged; it mixes with alcohol in all proportions, but not with water—10 parts of water taking up only 1 of ether.

Taking for granted that ether is an oxide of ethyl, will it not combine with oxacids, forming compounds similar to salts? — Yes.

What are the ethyl compounds? —

Ethyl, symbol Ae	C_4H_5
Oxide of ethyl — ether	C_4H_5O
Hydrate of oxide — alcohol	C_4H_5O,HO
Chloride of ethyl	C_4H_5Cl
Bromide of ethyl	C_4H_5Br
Iodide of ethyl	C_4H_5I
Cyanide of ethyl	C_4H_5Cy
Nitrate of oxide of ethyl	C_4H_5O,NO_5
Nitrite of oxide of ethyl	C_4H_5O,NO_3
Oxalate of oxide of ethyl	C_4H_5O,C_2O_3
Hydride of ethyl	C_4H_5H
Zinc — ethyl	C_4H_5Zn

&c. These compounds of ether and ethyl are formed by the action of any of the peculiar acids upon alcohol; the hydrate of the oxide, however, is only formed first by vinous fermentation.

How is the chloride of ethyl or light, hydrochloric ether, AeCl,

formed?—Rectified alcohol is saturated with dry hydrochloric acid gas, and the product distilled with a gentle heat, and the vapour conducted through tepid water in a wash bottle, and then conveyed into a receiver surrounded with ice and salt. It is purified by contact with pieces of fused chloride of calcium.

What are its properties?—It is a thin, colourless, volatile liquid, of a penetrating, aromatic odour. It boils at 50°; is soluble in 10 parts of water; is decomposed with chloride of potassium and alcohol, by a hot solution of caustic potash.

How is bromide of ethyl, or hydrobromic ether, AeBr, formed, what are its properties, &c.?—It is made by distilling a mixture of certain portions of bromine, phosphorus, and alcohol. It is a volatile liquid, boiling at 106°, and has a penetrating taste and smell, and is of greater density than water.

How is iodide of ethyl, or hydriodic ether, AeI, formed, and what are its properties, &c.?—By distilling a carefully-prepared mixture of iodine, alcohol, and phosphorus. It is a colourless liquid, of a penetrating, etherial odour; density, 1·92, and boils at 158°, and becomes red by contact with the air.

How is sulphate of oxide of ethyl, or sulphuric ether, AeO,SO_3, obtained, and what are its properties?—By passing the vapour of anhydrous sulphuric acid into perfectly anhydrous ether, a syrupy liquid is formed, which, being shaken with 4 vols. of water and 1 of ether, two layers are formed, the lower of which contains sulphovinic acid, &c., and the upper consists of an etherial solution of sulphate of ethyl. At a gentle heat the ether is volatilized, and the sulphate of ethyl remains as a colourless liquid.

How is the nitrate of oxide of ethyl, or nitric ether, AeO,NO_3 obtained?—By continuously distilling a mixture of equal weights of alcohol and moderate nitric acid, to which a small quantity of nitrate of urea has been added. It has a density 1·112; it is soluble in water, has an agreeable sweet taste and odour. Its vapour is apt to explode when strongly heated.

How is the hyponitrite of the oxide of ethyl, or nitrous ether, AeO,NO_3 obtained, and what are its properties?—By acting upon starch with nitric acid, and passing the vapour over dilute alcohol in a refrigerated receiver. It is a pale, yellow liquid, having the odour of apples; it boils at 62°, sp. gr. ·947. To it *sweet spirits of nitre* owes its efficacy. It is a solution of nitrous ether, *aldehyde*, &c., in alcohol. The other ethers are not of as much importance as the preceding; and as we have pointed out the general manner, &c., of producing them by the examples shown, we will omit them, and refer the student to treatises *upon* chemistry.

Which is the most important compound acid containing the elements of ether, and how is it formed, &c.?—Sulphovinic, $C_4H_5O,2SO_3,HO$. It is formed by mixing strong alcohol with double the weight of concentrated sulphuric acid, and then heating the mixture

and allowing it to cool; now it is diluted with water, and neutralized with chalk, when sulphate of lime is produced; from this, by draining and filtering, a crystalline product of *sulphovinate of lime* is formed of beautiful, colourless, transparent crystals, which dissolve in equal weights of cold water, and effloresce in a dry atmosphere; from these sulphovinic acid is produced by the action of sulphuric acid, which is sour, and forms sulphovinates with bases.

What is peculiar in the products of the decomposition of sulphovinic acid by heat? — They vary with the temperature to which the liquid has been subjected. When it is so diluted as to boil at 260°, or below, the compound acid is resolved into sulphuric acid and alcohol, and traces of ether are volatilized. When the boiling point of the acid is between 260° and 310°, it is decomposed by ebullition into hydrated sulphuric acid and ether, with small quantities of alcohol. When a large quantity of sulphuric acid is added, and the boiling point raised to 320°, and above it, the production of ether diminishes, and other substances appear; the principle of which is *olefiant* gas.

PRODUCTS OF THE OXIDATION OF ALCOHOL.

What effect is produced by the burning of alcohol and ether in air? — When they burn with flame, we have decomposition into carbonic acid and water. Under peculiar circumstances, these substances undergo partial oxidation, in which the hydrogen alone is affected, and the carbon is untouched. The result is a new-formed series, derived from a common radical, called *acetyl.* It is derived from ethyl by the oxidation and removal of 2 eq. of hydrogen

Mention the acetyl compounds. —

Acetyl (symbol Ac)	C_4H_3
Oxide of acetyl (unknown)	C_4H_3O
Hydrate of oxide of acetyl; aldehyde	C_4H_3O,HO
Acetylous acid; aldehydic acid	$C_4H_3O_2,HO$
Acetylic acid; acetic acid	$C_4H_3O_3,HO$

Acetyl and its protoxide are hypothetical.

What is aldehyde or acetol, or alcohol dehydrogenatus, how is it prepared, and its formula? — Formula, $C_4H_4O_2$, formed, by the action of oxidizing substances removing H_2 from alcohol. This may be done by passing the vapour of ether or alcohol through a red-hot tube, and by the action of chlorine or weak alcohol. It is best obtained by the aid of chromic acid acting upon alcohol. Bichromate of potash, strong alcohol, and sulphuric acid are mixed in a flask, when the reaction commences, and is kept up by gentle heat; the vapour, passing through a refrigerated tube, is condensed. The impure product is mixed with ether, saturated with ammonia; when a compound of aldehyde and ammonia separates in fine crystals; this is decomposed by sulphuric acid, affords pure aldehyde, a colourless liquid of a suffocating etherial odour, boiling at 70° and sp. gr. ·790,

and mixing readily with water. Aldehyde cannot be preserved unchanged, but is decomposed into elaldehyde and metaldehyde.

How is aldehydic acid, $C_4H_3O_2,HO$, obtained? — By digesting oxide of silver in excess with aldehyde, and precipitating with sulphuretted hydrogen.

How is acetic acid, or acetylic acid made, and what is its formula, &c.? — By exposing aldehyde to the air, when it absorbs O_2, and is converted into acetic acid. It may be formed by exposing alcohol-vapour mixed with air, in contact with sponge platinum, which slowly unites with oxygen to form aldehyde, which absorbs another portion of oxygen from the air, forming acetic acid, $C_4H_3O_3,HO$. In the ordinary process of making vinegar, alcoholic liquors, as wine or cider, are used. It is also obtained by distilling wood in close vessels, which contains other products also, and is called *pyroligneous acid*. It is procured on a large scale by distilling finely-powdered anhydrous acetate of soda with concentrated sulphuric acid; the liquid is purified, and exposed to a low temperature, when crystals of hydrate acetic acid form, which are taken from the liquid, and allowed to melt. At 63° the crystals melt and form a thin colourless liquid, very pungent, and blistering the skin. It mixes readily with water, alcohol, and ether, its sp. gr. is 1·063. It forms a number of important salts, soluble in water, as acetate of potash, soda, ammonia, acetate of lead, &c.

What is chloracetic acid? — By exposing a small quantity of crystallizable acetic acid in a bottle of dry chlorine gas, and exposing it to the sun's rays, the interior of the vessel is coated with a white crystalline substance, of this acid and oxalic acid, together with other products; the crystalline substance is dissolved out, and placed in the vacuum of the air-pump, with capsules containing fragments of caustic potash and sulphuric acid, when we have rhombic crystals of this, and also of oxalic acid, deposited. It is a colourless, deliquescent substance, faint odour, and powerfully acid taste, and destroying the skin. It forms a variety of salts.

What is acetone, or pyroacetic spirit, &c.? — When any of the anhydrous metallic acetates are subjected to destructive distillation they yield, among other products, a peculiar inflammable volatile liquid, of a peculiar odour; sp. gr. 0·792; boils at 132°; sp. gr. of vapour 2·022; it burns with a bright flame; mixes readily with alcohol water, and ether; various compounds are formed with this, and Nord hausen's sulphuric acid, with pentachloride of phosphorus, &c.

What is the *fuming liquor of Cadet?* — A preparation formed by distilling a mixture of dry acetate of potash and arsenious acid, which has been shown by Bunsen to be the oxide of a radical, which radical has been termed kakodyl, from its poisonous properties, and contains three elements, carbon, hydrogen, and arsenic. Formula for kakodyl is C_4H_6As, symb. Kd. It forms various important compounds, as the oxide, chloride, oxychloride, terchloride, bromide, iodide, cyanide, &c.

SUBSTANCES ALLIED TO ALCOHOL.

WOOD-SPIRIT, &C.

Whence is this derived? — By the destructive distillation of wood. It is a second alcohol, and forms compounds similar to vinous alcohol. It may be regarded as a hydrated oxide of a body like ethyl, containing C_2H_3, and called methyl, from μεθη, wine, and ὕλη, wood, which has not been isolated. A large number of compound methyl ethers have been described, bearing a strong analogy, in almost every particular, with vinous alcohol.

Give a further account of wood-spirit, or pyroxylic spirit. — Formula, MeO,HO; as ordinarily obtained, it is a volatile, weak liquid, which, by redistillation and rectification, is rendered a colourless, thin liquid, of peculiar odour, and burning, disagreeable taste; boils at 132°; sp. gr. 0·798; it mixes, when pure, in all proportions with water, and dissolves resins and oils.

What is the oxide of methyl, or wood ether, how prepared, &c.? — Formula, MeO; is prepared by distilling wood-spirits and concentrated sulphuric acid, and passing the gas through a solution of potassa, and collecting over mercury. It is a permanently gaseous compound, not liquefying at 3°, colourless, of an etherial odour, sp. gr. 1·617. We have compounds of chloride of methyl, cyanide of methyl, bromide, fluoride.

How is the sulphate of oxide of methyl, MeO,SO_3, obtained, &c.? — It is obtained by distilling wood-spirit and strong sulphuric acid together, carried nearly to dryness. The liquid produced is washed with water, and rectified by redistillation with powdered caustic baryta. The product is a colourless, oily liquid, of an alliaceous odour, sp. gr. 1·324, boiling at 370°, and decomposed by water into sulphomethylic acid and wood-spirits. There are, also, the nitrate, the oxalate of oxide of methyl, sulphomethylic acid, &c.

How is formic acid obtained, and what the rationale, &c.? — When ordinary alcohol is oxidized by means of sponge platinum, we have acetic acid; so wood-spirit, produced under similar influences, produces similar results, substituting 2 eq. of ox. for 2 eq. of hydrog., to which the above name has been given, from having first been discovered in *ants*. Pure hydrated formic acid has the formula, C_2HO_3, HO. It is a colourless liquid, boils at 212°, solid at 32°.

How is chloroform, or terchloride of formyl, obtained, its formula, &c.? — Its formula is C_2HCl_3. It is obtained by distilling alcohol, wood-spirit, and a solution of chloride of lime together; on a large scale it is produced by cautiously distilling together commercial chloride of lime water and alcohol. It is a thin, colourless liquid, of an agreeable etherial odour, and sweetish taste. It kindles with difficulty, and burns with a greenish flame. It is used extensively in surgery, &c., as an anæsthetic agent.

AMYLOL, AMYLIC ALCOHOL, OR POTATO OIL, &C.

How is this produced, and to what is it analogous, &c.?—In the rectification of the crude spirit obtained by the fermentation of the potato, this oil separates, which comes over with the last portion of the spirit, and is insoluble in water. It has been termed *fousel* or *fusel oil.* When pure, it is colourless, sp. gr. ·818, boils at 269°, it has a burning taste and pungent odour. Its chemical relations are analogous to alcohol and methol, with which it is homologous. Its formula is $C_{10}H_{11}O,HO$. It is a hydrate of the oxide of the organic radical *amyl*, containing $C_{10}H_{11}$. Its ether, and other compounds corresponding to ordinary alcohol, have been obtained.

What effect is produced upon potato-oil by oxydation?—By the action of sponge platinum, this oil combines with oxygen, and is converted into an acid homologous with acetic and formic acids; when heated with hydrate of potash, hydrogen is evolved, and a salt is formed of the same acid; and upon distilling the potash-salt with sulphuric acid, a new acid has been obtained, identical with valerianic acid, obtained from the valeriana officinalis; $C_{10}H_{10}O_4$ is its formula. It is colourless and oily, acid and caustic, has the odour of valerian, is soluble in a large quantity of water; sp. gr. ·937, and boils at 347°.

In ascending the series of alcohols, as they contain greater proportions of carbon and hydrogen, they are more insoluble in water, and assimilate to oils and fats, and wax.

BITTER-ALMOND OIL AND ITS PRODUCTS.

What is this supposed to be?—The hydride of a salt-basyle, containing $C_{14}H_5O_2$, called *benzoyl*, from its relation to benzoic acid, and is the radical of the series; which is a compound organic body, capable of entering into direct combination with elementary principles, as hydrogen, chlorine, and oxygen.

How is the hydride of benzoyl, or bitter-almond oil made?—This oil does not exist already formed in the bitter-almonds, but is obtained by the reaction of certain principles in the kernel, through the action of water. It is produced by distillation and purification. It is a colourless oily liquid, of a pungent, burning taste, and fragrant odour; it boils at 356°. Its vapour distils over with water at 212°; sp. gr. 1·073. When the crude oil of bitter-almonds is mixed with an alcoholic solution of potash, it is gradually converted into a white crystalline substance, called *benzoine.* When bitter-almond oil is exposed to the air it absorbs oxygen, and is converted into a white crystalline substance, which is *benzoic acid*, $C_{14}H_6O_4$, the same as that found in the plant, laurus benzoin.

How is benzoin, or phene obtained?—By passing the vapour of benzoic acid through a red-hot gun-barrel, by which it is decomposed into carbonic acid and this substance.

How is phenic alcohol or phenol, or carbolic acid obtained, and what its formula?—Formula, $C_{12}H_6O_2$. It is obtained by the decomposition of salicylic acid, which contains two more atoms of oxygen than benzoic acid. It is found in the natural secretion of the *beaver.*

VEGETABLE ACIDS.

Where do these exist?—They are widely diffused throughout the vegetable kingdom, either existing already formed, or produced by the agency of heat.

Mention some of the principle ones, which have not been already described?—Tartaric, citric, malic, tannic, and gallic.

Where is tartaric acid found?—In the acid of grapes, tamarinds, pine-apples, &c.; where it occurs as an acid potassa-salt, it is also found sometimes in combination with lime. For commerce, it is made from *tartar* or *argol*, an impure tartrate of potash, deposited from wine in the act of fermentation. After purification it constitutes *cream* of *tartar*, from which the acid is directly prepared by dissolving it in boiling water, then it is precipitated and rectified, and allowed to crystallize in a warm situation. Its crystals are colourless, transparent, oblique rhombic prisms, more or less modified; permanent in the air, and inodorous, and which dissolve in water and alcohol. It is bibasic, and contains $C_8H_4O_{10},2HO$. It forms various important combinations, as tartrate of potassa and soda, or rochelle-salt, tartrate of antimony and potassa, or tartar emetic.

What effect has heat upon tartaric acid?—When the crystallized acid is exposed to 200° of temperature it loses its water of crystallization, and passes into tartralic, tartrelic, and anhydrous tartaric acid. The two first are soluble in water, and form salts, with properties entirely different from tartaric acid; and the third is an insoluble powder.

What is racemic, or paratartaric acid?—The grapes grown in districts of the Upper Rhine, and some parts of France contain, in association with tartaric acid, this acid, which closely resembles tartaric.

Whence is citric acid obtained?—From the lemon, limes, the juice of the gooseberry, currants, &c. The juice is allowed to ferment; the clear liquor is saturated with chalk, forming an insoluble compound; then it is washed and decomposed by sulphuric acid, and the solution evaporated and crystallized. It is again washed and clarified, and concentrated to the crystallizing point. It is in colourless, prismatic crystals, of an agreeable acid taste: dissolve in hot and cold water. It is tribasic; the formula for the gently-dried anhydrous salt is $C_{12}H_5O_{11}$. It is decomposed by heating it with sulphuric and nitric acid, forming with the latter oxalic acid. It is frequently adulterated with tartaric acid, from which it may be distinguished by

testing with acetate of potassa, which throws down a white crystalline precipitate of cream of tartar upon shaking.

Whence is malic acid obtained? — From apples, pears, and other fruits, frequently associated with citric acid. It is bibasic. Formula, $C_8H_4O_8,2HO$, and forms a variety of salts. In the presence of fermenting substances, especially of putrifying casein, it is decomposed, forming succinic, acetic, and carbonic acid. It is colourless, slightly deliquescent, and soluble in water and alcohol. Recently a strong relation has been found between it and asparagin and aspartic acid.

Whence are tannic and gallic acids obtained?—From the oak-bark, galls, kino, catechu, &c.; they constitute the astringent principle of plants generally. Tannic acid refuses to crystallize. There may be modifications in the acid as obtained from different astringents, from the fact of the two salts of the sesquioxide of iron forming different coloured precipitates. One of the most prominent characteristics of tannic acid is that of forming insoluble compounds with organic and animal compounds (as seen in the process of tanning), which then acquires the property of resisting putrefaction. Carefully dried, its formula is $C_{18}H_5O_2,3HO$. It is soluble in water, less so in alcohol, and slightly in ether. Gallic acid is generally found in combination with the preceding; it is obtained when a solution of tannic acid is exposed to the air, from which it absorbs oxygen, and is formed in crystals, the tannin being decomposed. It forms feathery, nearly colourless, crystals; it requires a large quantity of cold water, and only a small quantity of hot water, to dissolve it; it does not precipitate gelatin. Gallic acid, dried at 212°, contains $C_7HO_3,2HO$. It is precipitated of a bluish-black colour, with the sesquioxide of iron.

AZOTIZED ORGANIC PRINCIPLES OF SIMPLE CONSTITUTION.

CYANOGEN AND ITS COMPOUNDS, &C.

This gas has been before studied under Inorganic Chemistry. It is important to be noticed here as the most perfect type of a quasi-simple sub-radical that is presented, and is interesting from being the first discovered body of the kind. It forms cyanide of hydrogen, or hydrocyanic acid, or prussic acid, H,Cy; this has been also studied before, and will be referred to again in the *Materia Medica.* Cyanogen forms compounds with potassium, sodium, mercury, silver.

What are cyanic and cyanuric acids? — Two isomeric bodies intimately related. The former is *the true* oxide of cyanogen, and is formed, together with cyanide of potassium, when cyanogen gas is passed over heated carbonate of potassa.

How is hydrated cyanic acid, CyO,Ho, formed? — By heating in a glass retort, with a receiver refrigerated with ice, cyanuric acid, deprived of its water of crystallization. It is condensed into a limpid, colourless liquid, of a pungent, penetrating odour. Water accompa-

nies it, giving rise to bicarbonate of ammonia. It cannot be preserved pure.

How is the cyanate of ammonia formed, and what change does it undergo, and present, in a compound form?—By mixing the vapour of hydrated cyanic acid with an excess of ammoniacal gas, a white, crystalline, solid substance is produced, dissolving in water, and, with an acid, evolving carbonic acid gas, and, with an alkali, ammonia. When a solution of this is heated, or exposed to the air, a portion of the ammonia is dissipated, and *urea* is formed—the chief characteristic of the urine.

How is urea obtained?—It may be extracted from its natural source, or formed artificially. Natural source—by concentrating fresh urine in a water-bath to one eighth of the original volume; it is then filtered and mixed with an equal quantity of oxalic acid in hot water, and vigorously shaken, and allowed to cool, when crystals of *oxalate* of *urea* are formed, which are filtered and washed. This is dissolved in boiling water, and chalk added till effervescence ceases. The solution of urea is now filtered from the oxalate of urine, and clarified, concentrated, and recrystallized. The artificial process has been referred to above. Urea forms transparent, colourless, four-sided prisms, soluble in an equal weight of cold water, in a much smaller quantity of hot, and also in alcohol. It is inodorous, has a cooling, saline taste, melts when heated, and, at a higher temperature, it is decomposed and evolves ammonia and cynate of ammonia. Its solution is neutral to test paper. Crystalline urea is anhydrous, $C_2H_4N_2O_2$; urea acts as a salt base.

How is uric or lithic acid obtained, what are its properties, &c.?—It is an animal product, never formed artificially. It is prepared by concentrating human urine and adding hydrochloric acid, when crystals of reddish, translucent grains are produced, which are difficult to purify. Under the microscope, crystals, as seen (Fig. 287), are found. Formula, $C_{10}H_2N_4O_4,2HO$; it is a bibasic acid. The urate of soda is an interesting compound, from forming the gouty concretions in joints, called *chalk stones*. The urate of ammonia deserves notice from forming one of the varieties of *calculi* in the bladder and kidneys.

Fig. 287.

How is urea tested?—By heating it with nitric acid, which dissolves the urea, and afterwards evaporating nearly to dryness; when, by the addition of water and ammonia, the deep-red tint of muroxide is produced.

VEGETO-ALKALIS, OR ALKALOIDS.

What is remarkable relative to this class?—They are met with in many plants, in combination with an acid, generally of a peculiar character; they have never been formed artificially; they are mostly

sparingly soluble in water, but soluble in hot alcohol, from which they crystallize on cooling. They have generally a bitter taste, and contain a large quantity of nitrogen. Several are oily and volatile.

What is morphia, or morphine?—The active principle of opium. Crystallized, it contains $C_{34}H_{19}NO_6,2HO$. It exists in opium as a meconate. It is prepared on a large scale by mixing an infusion of opium and chloride of calcium together, when meconate of lime is formed, and hydrochloric acid transferred to the alkaloids. The filtered solution is concentrated and crystallized, and clarified by animal charcoal, and recrystallized, from which hydrochlorate of morphia may be precipitated by ammonia. When crystallized from alcohol, it is in small, brilliant, prismatic, transparent, and colourless crystals, is slightly bitter, dissolves with difficulty in water, more readily in boiling alcohol and with facility in acids. It forms with acids the sulphate, muriate, and acetate.—[See *Materia Medica*].

What is narcotine?—One of the constituents of opium, and obtained by boiling the insoluble portion with dilute acetic acid. When the solution is filtered, and treated with ammonia, it is precipitated, and purified by boiling alcohol and clarification. It crystallizes in small, colourless, brilliant prisms, nearly insoluble in water. Formula, $C_{48}H_{25}NO_{14}$

How is codeine obtained?—It exists in opium, and is obtained in preparing hydrochlorate of morphine as before shown; and by dissolving it in water and adding ammonia, morphine is precipitated, and codeine is left in solution. It crystallizes spontaneously, in colourless, transparent crystals—octahedrons. Formula, $C_{36}H_{21}NO_6$. There are other minor substances in opium. There are numerous other alkaloids which will be treated of more particularly under their proper heads in *Materia Medica*.

OILS AND FATS.

How are oily bodies divided?—Into the fixed and volatile. The former are capable of being distilled without decomposition, the latter are not. The fixed oils leave a permanent greasy stain on paper, the others do not. They all have an attraction for oxygen, on which account they are further classified into drying and non-drying oils. To the first class, belong the oils used in painting, to the latter the palm and olive, and oils and fats of the animal body. The parts of plants containing the most oil are the seeds. Olive-oil is obtained from the fruit.

What is peculiar in regard to the fixed oils?—They have a feeble odour, and little taste; whenever a sapid or tasty oil is met with, it depends upon a volatile oil. They are insoluble in water, slightly so in alcohol, excepting castor-oil, and soluble in the essential oils and ether. They vary in consistence according to the variable proportions in which the proximate solid and fluid fatty principles are associated.

What are the most important proximate principles in oils, &c.?—Stearin and stearic acid in fixed animal oils; and margarin and margaric acids in vegetable oils; and olein or elain, the fluid portion of all oils.

What effect is produced upon fixed fatty bodies when exposed at a high temperature with an alkaline solution?—They are saponified or changed into *soap*.

What effect is produced upon the soap thus formed when decomposed by an acid?—The fat separated is changed entirely in character, which becomes an acid, and capable of forming salts. Stearin, when thus treated, yields stearic acid, margarin gives margaric acid, and olein yields oleic acid, and common animal fat. At the same time a peculiar, sweet substance is left in the mother-water; from which the acidified fat has been separated, called *glycerin*.

How is stearin and stearic acid obtained generally?—Animal stearin is obtained by mixing pure mutton-fat, melted in a glass tube, with several times its weight of ether, and suffering the whole to cool. Stearin crystallizes, and margarin and olein remain in solution, and, after pressing, recrystallize. In the saponification of stearin, glycerin and stearic acid are produced. Stearic acid is crystallized from hot alcohol in milk-white needles, which are inodorous and tasteless.

How is margarin and margaric acid produced?—The etherial mother-liquor from which stearin has been separated, yields a soft mixture of margarin and olein, with a little stearin, which, by pressing between folds of blotting-paper, and redissolving in ether, leaves it pure. By saponification it yields glycerin and margaric acid.

How is olein and oleic acid obtained?—It is very difficult to obtain pure; but, by decolourizing any animal or vegetable oil, and filtering at a temperature of the freezing point of water, we obtain a fair representative. Oleic acid resembles olein, but has an acid reaction, and is miscible with alcohol. By the action of nitric acid upon it, it forms almost the whole series of acids, of which formic, acetic, butyric, &c., are members.

What is the composition of stearic acid and margaric acid?—Stearic acid, $C_{68}H_{66}O_5.2HO$. Margaric acid, $C_{68}H_{66}O_6.2HO$. Margaric acid contains one equivalent more of oxygen than stearic acid.

How is glycerin obtained generally?—By heating together olive or a suitable oil, protoxide of lead, and water, as when lead-plaster is made; an insoluble soap of lead is formed, and *glycerin* remains in the aqueous liquid. Afterwards, it is treated with sulphuretted hydrogen, clarified by animal charcoal, and evaporated in vacuo at air temperature. It is when pure a colourless, sweet liquid; sp. gr. 1·27, and mixes with water. Nitric acid converts it into oxalic acid. Formula, $C_6H_8O_6$.

What does butter consist of?—A crystallizable and easily fusible fat, a fluid oily substance, consisting of olein, and a peculiar princi-

ple, called *butyrin* (which, by saponification, yields butyric, caproic, caprylic, and cupric volatile acids), and a yellow colouring matter, besides mechanical impurities, as casein.

What is *wax?*—This substance was supposed to be a vegetable production, and to be collected by bees from plants upon which they fed; but experiments prove it to be a natural secretion, as bees yield it when fed upon sugar or honey. Wax is separated into two proximate principles by boiling alcohol, into *cerin* and *mycerin.*

What is spermaceti?—A soft solid matter, found in the cranium of the sperm whale, in combination with an oil. It is a neutral, fatty body, of the constitution of compound ethers. It melts at 120°. It is saponified with difficulty, and produces two substances belonging to the series of alcohols, called cetylic (ethalic) alcohol, and cetylic (ethalic) acid. By oxidation with nitric acid, succinic acid is produced.

What is cholesterin?—It is found in the bile, the brain, nerves and blood, in small quantities, and is the chief ingredient of gall-stones. It has the characteristics of a fat, but resists saponification. It melts at 278°, and probably contains $C_{26}H_{22}O$.

VOLATILE OILS.

What are the properties of volatile oils, and how are they obtained?—They are numerous, and are secreted by plants, and confer flavour upon flowers, fruits, &c. They are prepared by distilling the plant with water at 212°—the vapour being of considerable tension. When pure, they are colourless, the odour is powerful, and taste pungent and burning. They resist saponification; by exposure to the air they absorb oxygen, and become thickened. They mix in all proportions with alcohol and ether.

How are essential or volatile oils divided?—Those containing carbon and hydrogen only, those of carbon, hydrogen, and oxygen, and those containing in addition sulphur and nitrogen.

What are those containing carbon and hydrogen?—Oil of turpentine, oil of lemons, oil of orange-peel, bergamot, pepper.

What are those containing carbon, hydrogen, and oxygen?—Oil of aniseed, oil of cumin, gaultheria procumbens, peppermint, lavender, rosemary, &c.

Which are those containing sulphur?—Oil of mustard, garlic, &c.

What is camphor?—A concrete, essential oil, $C_{10}H_8O$, obtained by distilling with water the wood of the laurus camphora.

RESINS AND BALSAMS.

What are the characteristics of resins?—Common resin is a good example; it exists in combination with the volatile oil of turpentine in the pine tree, from the turpentine of which it is obtained by distillation, affording the oil of turpentine and leaving the resin behind. It is a mixture of two distinct bodies having acid properties, called

pinic and sylvic acids. Resins are insoluble in water, and soluble in alcohol, and volatile and fixed oils. They are inflammable, and yield, on distillation, carburetted hydrogen, &c.: a small amount of heat renders them adhesive. They saponify. The addition of nitric acid renders them explosive. We have a variety of resins, as lac, shellac, mastic, sandrac, copal. Amber is a fossil resin.

What is caoutchouc, or India-rubber, and gutta percha?—An elastic substance exuding from certain trees of the tropics; when first exuded it is white, but becomes dark by exposure, smoke, &c. Few chemical agents affect it. It is composed of carbon and hydrogen. Gutta percha resembles the preceding in many respects; it is harder, when cold, than India-rubber; it softens easily and can be moulded by heat. Most of the resins differ only as regards their boiling points.

What are balsams?—Compounds of resin, volatile oil, and benzoic acid, which are properly balsams, as those of Tolu and Peru, containing, as said, benzoic acid. Venice turpentine, Canada balsam, and copaiba balsam, &c., are called balsams, though improperly.

COMPONENTS OF THE ANIMAL BODY.

ALBUMINOUS PRINCIPLES.

What is albumen?—The white of eggs, and the serum of blood drawn for some time, are examples. When perfectly pure, it is insoluble in water, unless a small quantity of alkali is present. It is coagulated by acids, by heat, alcohol, electricity; most of the metallic salts, as those of copper, lead, mercury, &c., precipitate it. It is the proper antidote for poisoning by corrosive sublimate. It is composed of carbon, hydrogen, nitrogen, oxygen, phosphorus, and sulphur.

What is fibrin?—It exists in muscular fibre, and may be procured from freshly-drawn blood by whipping it with twigs. It exists in solution in the blood: on account of it, blood coagulates. It consists of one equivalent less of sulphur than albumen. Arterial and venous fibrin are not absolutely the same. When fibrin is burned, the ash is composed of phosphate of lime chiefly.

What is casein?—The azotized component of milk and the basis of cheese; it does not occur in any other secretion; it resembles albumen; a small portion of free alkali renders it soluble in water; it does not coagulate by boiling; it does not contain phosphorus as the preceding do; it is coagulable by certain animal membranes.

What is understood from the term protein?—It is derived from πρωτεύω, *"I take the first place."* It is found by recent experiment to be one of the first products of the decomposition of albumen, fibrin, and casein, by moderately strong fixed alkali, and neutralizing with sulphuric acid.

What is gelatin and chondrin?—Gelatin is procured from animal membranes, &c., by boiling. It does not pre-exist, but is formed by the action of boiling water. Calves' feet jelly, glue, and isinglass,

from the swimming-bladder of the sturgeon are familiar examples; an aqueous solution of gelatin is precipitated by alcohol, also corrosive sublimate, but not by alum and acetate of lead; tannic acid or a solution of galls give a copious precipitate. When a dilute solution of gelatin is distilled with bichromate of potassa and sulphuric acid, we have the extraordinary products of acetic, valerianic, benzoic, and hydrocyanic acid, and two volatile oily principles. Dry gelatin consists of carbon, hydrogen, nitrogen, and oxygen. Chondrin is the gelatin produced from the cartilages of the ribs, joints, &c.

What is kreatin and kreatinine? — A product obtained from lean-flesh soups. It is a neutral body. By the action of strong acids upon kreatin, kreatinine is produced, a powerful *organic* base.

We will refer here to a few products of the body to which we could not draw as direct attention in other parts of the work.

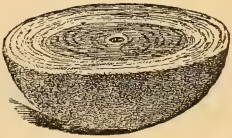
What is mucus and pus? — The slimy matter lining the mucous membranes in different parts of the body. It is usually alkaline to test paper, insoluble in water and heavier than water; mucus, from different mucous membranes, differs in appearance, and probably in chemical composition. Under the microscrope we have two portions exhibited, mucus corpuscles with epithelial scales, and fluid with which they are surrounded. It appears to contain in its composition, mucus corpuscles, epithelial scales, mucin, to which the tenacity of mucus is attributable, traces of extractive matters, of fat, sometimes albumen, and saline matters. It dissolves in dilute alkalies, and is precipitated by an acid. Pus is the peculiar secretion of abscesses, ulcers, &c., and suppurating wounds; when healthy, it is of a creamy colour and consistence; under the microscope, pus corpuscles are seen (Fig. 288,) floating in a fluid portion. When mixed with acetic acid, the pus globules are rendered transparent, and show the nuclei. It is neither alkaline nor acid. By mixing with a solution of ammonia, pus loses its fluidity, and assumes a jelly-like consistence.

Fig. 288.

What are the ordinary components of urinary calculi? — Uric acid, urate of ammonia, fusible calculus, or phosphate of lime, with phosphate of magnesia and ammonia, oxalate of lime, and cystic and xanthic oxides, &c.

What are the characteristics of a uric acid calculi? (Fig. 289.)— They are the most common, having a concentric arrangement; externally smooth or warty, of yellowish or brownish tint, and imperfectly crystalline. They are destroyed before the blow-pipe: and are insoluble in water. Cautiously heated with nitric acid, and mixed with ammonia, we have the characteristic deep purple-red muroxide.

Fig. 289.



What are the characteristics of urate of ammonia calculi?—They resemble the preceding, but are distinguished by boiling the powder, and dissolving it; and hydrochloric acid gives a precipitate of uric acid. Hot carbonate of potassa in solution dissolves it, evolving ammonia. (Fig. 290.)

Fig. 290.

What are the characteristics of fusible calculus?—It is one of the most common kinds. They are generally white or ash-coloured, smooth and earthy. Before the blow-pipe it burns black; it then becomes white, and melts readily to a bead. It is insoluble in caustic alkali, but is precipitated by ammonia. Calculi of the unmixed phosphates are rare. (Fig. 291).

What are the marks of the oxalate of lime, or mulberry calculus?—It is the hardest calculus met with. It has a rough, brownish, warty exterior, its layers are thick. Before the blow-pipe, with a moderate heat, we have the carbonate produced, and with more intense heat, quick-lime. It is easily soluble in nitric acid, and less so in hydrochloric. (Fig. 292.) The cystic and xanthic oxides are rare.

Fig. 291.

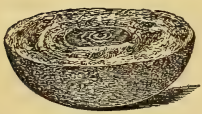
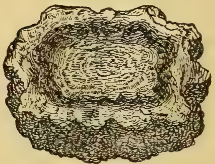


Fig. 292.



How are they known?—The first is of a light brown colour, is rendered resinous by friction, dissolves in a solution of caustic potassa, from which it is precipitated by carbonic acid; the second is yellowish-white, and crystalline, and is dissolved by caustic potassa, ammonia, and by the mineral acids.

PART VI.

OBSTETRICS, ETC.

PECULIARITIES OF THE FEMALE.

MENTION some of the peculiarities of the female.—The whole skeleton is lighter and more delicate than that of the male, while the pelvis is wider, and the thorax narrower. The integuments are softer, and the general contour of the body rounder and more plump than in the male. There is no beard, as a general rule, upon the face, and the mammæ are more developed than in man; besides these, we have the organs peculiar to the sex, which we will notice hereafter.

Describe the female mammæ, their situation, &c.—These are two glandular bodies situated upon the large pectoral muscles, on the upper, anterior portion of the thorax, and covered by the ordinary integuments, they consist of a nipple or red-coloured projection from the middle of the breasts, which is capable of erection, with from twenty to twenty-five lactiferous tubes, which terminate upon the surface of the nipple. The areola or rose-coloured circle in virgins, or the brownish circle in females who have borne children, surrounds the nipples and is supplied with numerous follicles. The glandular substance of the mammæ are imbedded in fat, and consist of numerous separate glandular portions, from which the lactiferous tubes arise which enter the nipple. The mammæ become much enlarged at puberty

What is the office of the mammæ?—To secrete milk for the nourishment of the offspring.

What are the peculiarities of the female pelvis?—It is larger, and more delicately formed than the male. The alæ of the ilia spread themselves widely in the lateral direction, while in the male they rise more perpendicularly; the brim of the female pelvis is largest from side to side, and in the male from before backward; the cavity of the

female pelvis is larger, and more capacious, and the sacrum more curved than in the male. The outlet of the pelvis is broader than in the male, and in the female is more arched; the rami of the ischia and pubes are also much smoother on their inner surfaces, and the anterior edges turned more outwards.

ANATOMY OF THE PELVIS.

(For the general configuration and composition of the bony pelvis, we refer to *Anatomy*, &c., pages 32, 33, 34, &c.)

How is the pelvis divided by obstetricians? — Into the upper and lower portions, by the linea ilio-pectinea, a ridge extending from the crest of the pubis, between the ilium and ischium, &c., to the junction of the ilium with the sacrum.

What is the appearance of the upper portion, or false pelvis? — It is defective in front, elevated at the sides, and has posteriorly the promontory of the sacrum and lumbar vertebræ in part.

What are the measurements of the upper pelvis? — From one anterior superior spinous process to the other, across the pelvis, nine inches; from the middle of the crest of one ilium to the same point in the opposite one across, eleven inches; and from the top of the crest of the ilium to the linea ilio-pectinea of the same side, three and a half inches.

What is the appearance of the lower, or true pelvis? — That of an inverted cone, with two straits, and a basin or cavity.

Describe these straits and the cavity of the pelvis. — The superior strait is elliptical in shape, and formed by the top of the symphysis pubis, the linea ilio-pectinea, and the promontory of the sacrum. The inferior strait is oval in shape, consisting of the rami of the pubis and ischia on the sides, the sub-pubic ligament in front, and the sacro-ischiatic ligaments and coccyx behind; the cavity of the pelvis is that part of it contained between the superior and inferior straits.

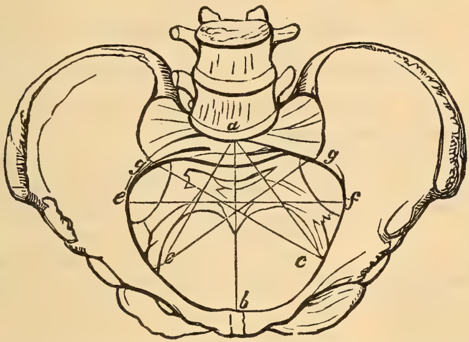
Give the axis and measurements of the superior strait. — The axis is an imaginary line drawn from the point of the coccyx at right angles to the strait, and which, if continued, would pass out at the umbilicus; the circumference of the strait is thirteen inches; the sacro-pubic diameter, four inches; the oblique diameters from points in the two linea ilio-pectinea to the opposite sacro-iliac symphyses, each of them are five inches; the transverse or bis-iliac diameter, five and a quarter inches. Two others diameters are sometimes given, as from points in the linea ilio-pectinea to the promontory of the sacrum (Fig. 293).

Give the axis and measurements of the inferior strait? — The circumference of the strait is twelve inches; the anterior posterior diameter from pubic ligament to coccyx, from four and a half to five inches; the transverse or bis-ischiatic diameter, four inches; and the oblique diameters, each of them four inches. Its axis is an imaginary

line drawn from the middle bone of the sacrum and out of the pelvis, midway between the rami of the pubis and ischium of each side.

What other measurements are there which should be noted? — From the top of the symphysis pubis to the lower edge of the sub-pubic ligament, one and a half inches; from the top of the sacrum to the point of the coccyx anteriorly, five, five and a half, and six

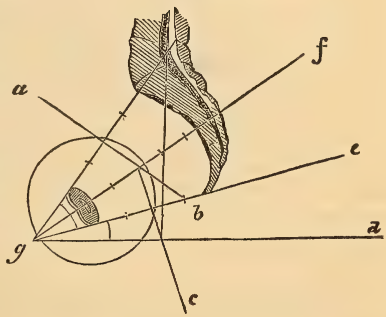
Fig. 293.



inches; from the linea ilio-pectinea to the tuberosity of the ischium, for each side, three and a half inches; from the sub-pubic ligament to the top of the promontory of the sacrum, four and a half inches; from the sub-pubic ligament to the hollow of the sacrum, four and three-quarter inches.

What are the inclined planes of the pelvis? — There are two for each side of the pelvis. The anterior one is all that part of the pelvis in front of a line drawn from the spine of the ischium, obliquely up to a point midway between the two extremities of the crest of the ilium, and embraces all the anterior portion of the pelvis to the symphysis pubis of the one side; and the posterior plane is directly back of the anterior, extending to the middle line of the sacrum; the anterior plane is the larger.

Fig. 294.



What is the axis of the pelvis?—An imaginary curved line, drawn through the middle of its cavity, and passing out with the axis of the superior strait superiorly, and with the axis of the inferior strait inferiorly.

How does Dr. Carus show clearly this axis of the pelvis? — By placing the leg of a pair of compasses (in a bisected pelvis) upon the posterior edge of the symphysis pubis, and the other leg extended two and a quarter inches, being half the antero posterior diameter of the pelvis. A circle is then described, commencing at the plane of the superior strait, and continued through *g f*, *g e*, and *g a*, the point of departure. (Fig. 294).

SEXUAL ORGANS.

EXTERNAL GENITAL ORGANS

What are the external genital organs? (Fig. 295.) — The mons veneris, the vulva, and perineum.

What is the mons veneris? — The eminence upon the top of the pubis, composed of fat, fibrous filaments, and cellular tissue, and covered with skin, upon which are hairs, in the adult.

Fig. 295.

What are the labia majora? — Cutaneous folds, which pass down from the lower part of the mons veneris, and separate farther and farther to about their middle, and then approach, to be again united about an inch in front of the anus; they are covered externally by skin, and with hairs at puberty, and lined with a smooth, rose-coloured membrane, which abounds in sebaceous or mucous follicles.

What is the fissure which these labia bound called? — The vulva.

What are contained in this fissure, or vulva, from above downwards? — The lesser labia or nymphæ, the clitoris, the vestibule, the meatus urinarius, the vulvar orifice of the vagina, the hymen, the fossa-navicularis, and the fourchette.

Describe the nymphæ. — They are two folds of the inner skin of the labia majora, situated internal to the labia majora; they are narrow above, broader below, and contract again at their lower part; they are erectile, cellular, and vascular in structure, covered with a rose-coloured epithelium.

Describe the clitoris. — It is an oblong, firm, projecting body, immediately under the superior commissure of the labia, at the beginning of the nymphæ, called præputium; it consists of two corpora cavernosa, united together anteriorly, forming the gland; and it is divided posteriorly into two crura, which are attached to the rami of the pubis.

What is the use of the clitoris? — It is capable of erection, and is supposed to be the principal seat of sensation in coition.

What is the vestibule? — That small, triangular, depressed space, corresponding to the upper part of the arch of the pubis, circumscribed by the clitoris, the inner face of the nymphæ, and the meatus urinarius.

Where is the opening to the urethra? — Beneath the vestibule we find an orifice, which is the opening to the urethra, and separated from the vagina by a tubercle.

Describe the female urethra. — It is large, about an inch long, and with a slight curve, and passes slightly behind the symphysis pubis.

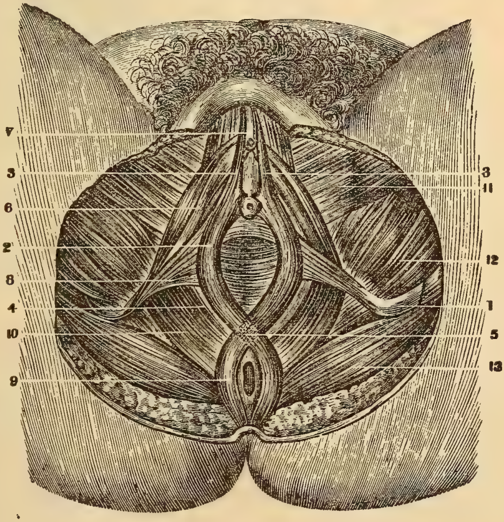
What bounds the orifice of the vagina? (Fig. 296.)—The sphincter vaginæ muscle, arising from the union of the crura clitoridis; it is inserted into the sphincter ani, and also into the sides of the vagina, which it partly surrounds.

What is the membrane called which is generally found near the external orifice of the vagina of virgins, and partially closing it? — The hymen, a duplicature of the lining membrane of the vagina.

What is the shape of the orifice in the hymen? — Sometimes triangular, at other times oval, &c.

When is the hymen generally ruptured? — At the first sexual intercourse.

Fig. 296.



What becomes of the lacerated hymen? — It cicatrizes, forming what are called myrtiform caruncles.

What are those parts called at the superior and inferior portions of the vulva? — The superior and inferior commissures.

Where is the perineum situated?—From the posterior commissure of the vulva to the point of the coccyx.

Is not this very distensible?—Yes.

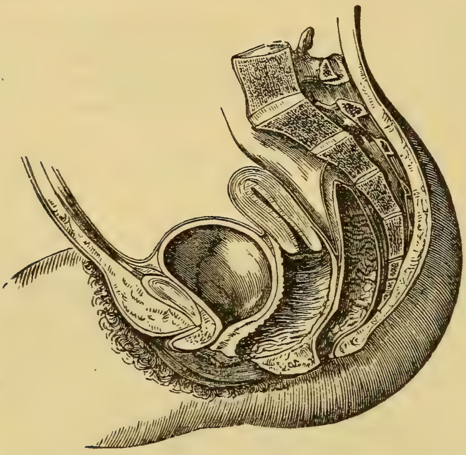
Where is the fossa navicularis situated?—At the anterior inferior portion of the hymen.

Where is the fourchette?—At the inferior boundary of the vulva.

INTERNAL GENITAL ORGANS.

Give a general description of the internal organs, as seen in the recent pelvis? (Fig. 297)—First, we have the urethra entering under

Fig. 297.



the symphysis pubis, and running back and up to the bladder—in this instance distended; back of this the vagina, with the uterus at the top of it, and projecting into it with its neck and mouth; and a little to the left side of the uterus we have the rectum.

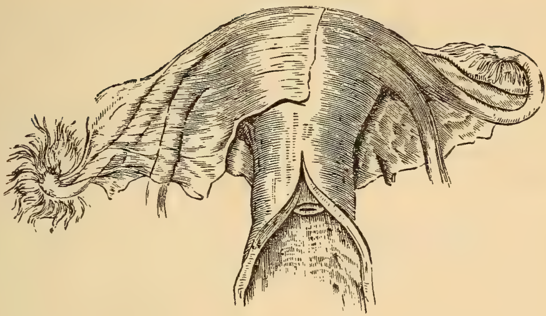
What are the internal genital organs?—The uterus, the vagina, the fallopian tubes, ovaries, and ligamentous attachments.

What is the uterus? (Fig. 298)—A hollow, pear-shaped muscular organ, to lodge and nourish the ovum during pregnancy, and to expel it in the process of labour.

Where is it situated?—In the pelvis, behind the bladder, in front of the rectum, beneath the small intestines, and continuous below with the vagina; in the unimpregnated state it is in the direction of the axis of the superior strait.

How is the uterus divided?—Into fundus, body, and neck; the fundus is that portion above the origin of the fallopian tubes; the body is below the origin of these tubes and the neck of the uterus; and the neck is the lower portion of the organ.

Fig. 298.

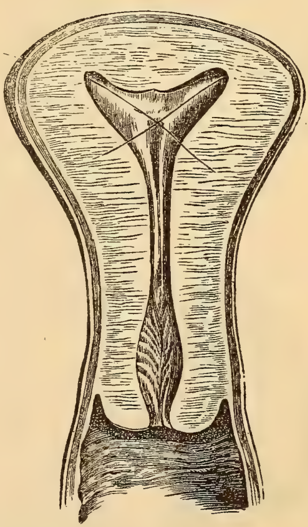


How many sides and angles has the uterus?—Three.

What orifice is situated at the extremity of the inferior angle?—The orifice of the mouth of the uterus or os tincæ.

What is the state of the mouth of the womb?—It is transverse, small at first, but becomes more open and rugged after a female has had a child. The inferior lip of this orifice is thicker, broader, and longer than the superior.

Fig. 299.



How do you divide the internal surface of the womb?—Into the cavity of the body and the cavity of the neck of the womb.

What is the state of the cavity of the body of the uterus? (Fig. 299)—It is of a triangular shape, with the sides slightly separated; the sides and bottom of this cavity are almost straight; sometimes convex in young girls, but are generally concave after a delivery; the inferior angle is the point where the two cavities of the womb communicate with each other, and is sometimes called the internal orifice of the uterus.

What is the situation and appearance of the cavity of the neck of the uterus?—It is below the internal orifice of the uterus, and is barrel-shaped, and arborescent in appearance.

Where are those small vesicles, sometimes called ovula Nabothi,

found?—In the folds of the mucous membrane of the neck of the uterus.

What is the lining membrane of the uterus?—Mucous membrane. In the healthy condition it is pale in colour, about a line in depth, and forms a thin layer; one aspect of which is free, and the other closely united to the proper tissue of the walls of the uterus. In the unimpregnated uterus, upon this tissue, we find openings of the tubular coiled glands of the mucous membrane. The opinion relative to the secretion from these glands is different; the most probable is that, they elaborate the material from which the decidua reflexa is formed. The mucous surface is covered in the cavity of the body with cylindrical and ciliated epithelium, and the cilia vibrate from below upwards, favouring the ascent of the spermatozoa. In the lower part of the cavity of the neck, the vaginal aspect of the os and neck is covered by squamous epithelium. The secretion which takes place in the cavity of the neck is alkaline, while that of the external os is acid; depending, it is said, upon the squamous (or acid), and the cylindrical (or alkaline forming) epithelium.

What are the dimensions of the womb?—Unimpregnated, it is about 2½ inches long; 1½ wide at the superior angles; its neck is about an inch long, and its body is half an inch thick.

What is the structure of the uterus, and what are the directions of its fibres?—It is muscular, with two sets of fibres, the circular and longitudinal. It has been said, according to recent researches, that the substance of the uterus is made up of a connective tissue and a large number of fusiform fibre-cells; fibre-germs or embryonic nucleated cells having the power to be developed into non-striated muscular fibres.

What membrane partially invests the uterus exteriorly?—The peritoneal.

Fig. 300.

What and where are the fallopian tubes?—They are two small, hollow cylinders, four or five inches long, as large as the barrel of a quill; and extending from the superior angles of the uterus to near the iliac fossa of each side, where each terminates in a fimbriated extremity, and are inclosed within the upper edges of the broad ligaments.

What is their structure?—Similar to that of the uterus.

Where are the ovaries situated?—In the upper part of the broad ligaments, behind and a little below the fallopian tubes, and near the superior angles of the uterus, to which they are attached by the *ligament of the ovaries.* (Fig. 300).

Describe the ovaries.—They are oblong bodies, flattened antero-posteriorly, and are about the size and shape of a large almond; their surface is gene

rally smooth in those who have never been fecundated, but in those who have had children they are filled with irregularities.

What is found in the parenchyma of the ovaries about the age of puberty? — The Graafian vesicles, or vesicles which contain germs.

What is the office of the ovaries? — They are the seats of conception.

What is meant by a corpus luteum? — The yellow body which remains after the ovule has escaped from the ovary.

What are the broad ligaments of the uterus? — Expansions of the peritoneum from the sides of the uterus to the lateral and posterior portions of the pelvis.

What and where are the other ligaments of the uterus?—The anterior or round ligaments, arising from the upper part of the body of the uterus, pass out at the abdominal rings, and are lost in the mons veneris and the utero-sacral ligaments, which pass from the back of the uterus to the sides of the sacrum.

Where is the vagina situated? — In the axis of the inferior strait, and it forms an angle of about 65° with the great diameter of the womb.

What is its length? — From four to six inches.

What is the anatomical structure of the vagina? — It is muscular and cellular, with a lining of mucous membrane, in an arborescent arrangement.

How does the vagina pass from the uterus, and how does it terminate anteriorly? — It passes off immediately from the anterior surface of the womb, but posteriorly it passes up some distance before passing down, and forms by this arrangement a cul-de-sac; at the anterior extremity it terminates in an opening in the vulva, of about an inch or an inch and a half, antero-posteriorly.

Whence are the arteries of the uterus and its appendages derived? — From the spermatic and hypogastric.

Whence are the veins of the uterus and its appendages derived?— From the spermatic and uterine, which flow into the hypogastric.

Whence are the absorbents of the uterus and its appendages derived? — From the hypogastric and spermatic.

Do not the arteries, veins, absorbents, and nerves of the uterus become much enlarged during pregnancy? — Yes.

Whence are the nerves of the uterus derived? — From the great sympathetic and sacral. [For an interesting account of the recent dissections, and more ample information in regard to the origin, situation, and distribution of the uterine nerves, we would refer to Lee's Theory and Practice of Midwifery, pages 98—116 inclusive. Pa Edition.

MENSTRUATION AND ITS IRREGULARITIES, ETC.

What are the menses? — A peculiar discharge from the sexual parts, which consists chiefly of blood, modified by the ordinary secre-

tions and matters derived from the uterus and vagina. Dr. Whitehead says that the menstrual fluid as it escapes from the os uteri is alkaline, but becomes acid when mixed with the acid vaginal secretion, and this acidity prevents its coagulating or decomposing in passing through the vagina; it takes place at the age of puberty in girls, and occurs every twenty-eight days during their menstrual life, except, as a general rule, when pregnant, nursing, or unhealthy.

What are the changes which take place in the female at the age of puberty? — The uterine organs become enlarged and developed, the voice changes, the moral sensiblility is more acute, the breasts enlarge, and, finally, the menses flow, and the female now becomes susceptible of being fecundated.

At what age do these changes usually take place? — According to Dr. Tilt, the difference between the times of first menstruation in hot and cold climates is about three years; and, according to Mr. Roberton, in the Hindoo it generally occurs about 13, and in England and this country, about 15; in Labrador, about 16. The catamenia occur earlier in the children of the rich than the poor. It is probable that climate, hygiene, temperament, and race, all exert an influence in promoting or retarding puberty, but within narrower limits than was once supposed.

Where does this fluid come from? — From the cavity of the body and neck of the uterus.

What are some of the common names for the menses? — Courses, reds, monthlies, and, being unwell or indisposed.

When the menses are about coming on, what are the signs of their approach? — There is a sense of fulness in the loins and neighboring parts, a feeling of languor, swelling of the breasts, headach, and sometimes hysterical symptoms.

How long do the menses generally continue at each recurrence, and what is the quantity discharged? — From five to seven days, and the quantity discharged from four to six ounces.

Is not this function easily disturbed? — Yes.

How many years does this function last, and when does it cease? — From thirty-five to forty years, and generally ceases from the forty-fifth to the fiftieth year.

Do we know of any other cause for the production of menstruation besides the existence of the ovaries? — No.

Do not females sometimes conceive without menstruating? — Yes.

When do they more easily conceive? — Immediately after the menses have flown.

Are the menses noxious? — No.

What are the signs of a change of life in the female, or the cessation of the menses? — The female loses her rotundity of form, the capillary circulation is diminished, and the female begins to assume the appearance of old age, &c.

When the female does not menstruate regularly during her men-

strual life, and her system is full and plethoric, what should be done? — Resort to the lancet, saline cathartics, &c.

If, on the contrary, her system is feeble, and her health impaired, what is the treatment?—Administer tonics, and enjoin exercise, with a healthy and nutritious diet.

What is meant by retention of the menses?—The non-appearance of them, notwithstanding the age of the patient.

What is meant by a suppression of the menses? — Their cessation of appearance, during the menstrual life of the female, after having once made their appearance.

What is the technical name for either of these? — Amenorrhœa.

What are sometimes the causes of a non-appearance of the menses at the proper time? — Disease, or want of proper development in the female system.

Do females always suffer from the absence of the appearance of the menses at the proper time? — No.

What is meant by the term chlorosis, or green sickness? — A general anemic condition of the system, with a functional derangement of most of the organs of the body.

What is the character of the menstrual discharge, if it does take place in this state of the system? — Generally serous.

What is necessary to be done in a case of chlorosis? — Invigorate the system by exercise, preparations of iron, healthy diet, &c.

Are not the menses sometimes retained by mechanical means? — Yes.

What are the forms of the suppression of the menses?—The acute, or the discharge being suppressed during their actual flow; and the chronic, where the cause acts antecedently to prevent their appearance at the proper time.

What kind of a discharge sometimes takes place as a substitute for the real menses? — A white discharge, or leucorrhœa.

Do the mammæ ever become sympathetically affected when the uterus is affected? — Yes.

Are emmenagogues beneficial in chronic amenorrhœa? — Yes.

What is meant by the term dysmenorrhœa?—Painful menstruation.

What is the probable cause of this? — Either slowness in the secretion of the menstrual fluid, or a difficulty in passing the fluid when secreted.

What are the symptoms of dysmenorrhœa? — Coldness of the extremities, nervous chills, headache, and pain in the lower portion of the abdomen and back, and of a paroxysmal character, occurring at the menstrual periods.

What is generally the nature of the discharge in dysmenorrhœa? —Membranous, and in coagula.

Do females with dysmenorrhœa conceive easily?—No.

What should be done in cases of dysmenorrhœa? — During the paroxysms, resort to topical depletion, warm, stimulating enemata per

vaginam, and the warm hip-bath and anodynes internally; and, in the intervals between the paroxysms, endeavour to remove the causes of the disease by means of alteratives, and reducing the general circulation if too vigorous, or increasing it by tonics if there is anemia.

How would you relieve dysmenorrhœa from mechanical obstruction?—By dilating the neck of the womb by bougies, &c.; or if the hymen is entire, make an opening into it.

What is meant by menorrhagia?—An increased or excessive secretion of the menses.

What are some of the exciting causes of this?—Either great nervous or vascular excitement, or great internal congestions, or displacements of the womb, &c.

With what may menorrhagia be confounded?—With a real uterine hemorrhage, arising, either from polypus, ulcers, or abortion, &c.

How can you be sure of your diagnosis in these cases?—By an examination per vaginam.

What effect has menorrhagia upon the system?—It debilitates it.

What medicines should be administered in cases of menorrhagia?—Astringents and tonics; the oleum erigeron Philadelphicum is exceedingly valuable.

THE FŒTAL SKELETON.

What is the condition of the skeleton of the fœtus?—Imperfectly ossified.

What is the length of a fœtus?—From eighteen to twenty inches.

What are the various important measurements of the fœtus?—From acromion to acromion, four inches, which may be compressed to three. The dorso-thoracic, three and a half or four inches, which may be reduced to two. From trochanter to trochanter, two and a half to three inches. From the sacrum to anterior part of thighs when flexed forward, three inches. Antero-posterior diameter of pelvis, one and a half to two inches.

How is the fœtal cranium divided?—Into the compressible and incompressible portions.

What are the various surfaces and extremities called?—Occipital and mental extremities, and a superior and inferior and two lateral surfaces, and an anterior and posterior extremity.

What are the principal sutures on the fœtal cranium?—The lambdoid, running between the parietal and occipital bones; the sagittal, between the two parietal bones; the coronal, between the parietal and frontal bones; the frontal, between the two edges of the frontal bones (before they are united into one), extending to the root of the nose.

Where is the anterior fontanel or bregma situated, and what is its shape?—At the anterior angle of the parietal bones, and at the upper posterior angle of the frontal bone. It is kite-shaped, or quadrangled.

Where is the posterior fontanel?—At the junction of the tip of the lambdoidal suture with the posterior extremity of the sagittal suture, and is triangular.

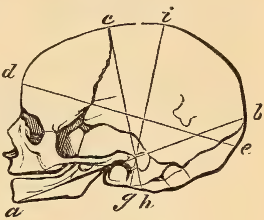
Are these sutures and fontanels of importance in obstetrics?—Yes; to form a correct diagnosis of the position of the child's head when in the cavity of the pelvis.

Are there any other fontanels?—Yes; at the posterior, inferior edges of the parietal bones.

Where is the vertex situated?—It is the point in the centre of the space bounded by the occipital protuberance, the parietal protuberances, and the middle point of the sagittal suture.

What are the various measurements of the fœtal cranium? (Fig. 301.)—The bi-parietal diameter, three to three and a half inches; the occipito-bregmatic, or perpendicular diameter, three to three and a half; the occipito-frontal, four; the transverse, three to three and a half; the trachelo-bregmatic, three and a half; bi-temporal, two and a half inches; the occipito-mental, five inches; occipito-frontal, four inches.

Fig. 301.



What are the measurements of the facial extremity of the fœtal ellipse?—From the top of the forehead to the end of the chin, or fronto-mental, three inches; and the bi-malar, two and a half inches.

What are the various degrees of elongation and compressibility to which some of those diameters mentioned before may be subject?—The occipito-mental may be elongated to six or seven inches, and the bi-parietal may be compressed to three inches.

GENERATION, ETC.

What is meant by generation?—That function of animated beings necessary to the reproduction of their own species.

What is the form of generation applicable to the human race?—The gemniparous, or the formation by germs.

Where are the germs of male and female situated?—That of females in the ovaries, and that of the male in the semen or fluid secreted by the testicles.

What is necessary in order that conception should take place?—The union of these germs.

What are the principal theories of conception?—That of epigenesis, or the junction of the two germs in the uterus, and that each forms part of the new being; or that of evolution, where the mother furnishes the entire germ, and it is stimulated to action by the male germ.

Which theory is now most generally adopted? — That of ovular evolution.

Where are the two germs supposed to meet? — In the ovary.

Is copulation absolutely necessary in all mammiferous animals to produce conception? — Yes.

What is meant by viviparous generation? — When the ovum, after being detached from the ovary, is brought to maturity in the cavity of the uterus.

What changes occur in the ovum after fecundation? — As the ovule approaches maturity, and makes its exit from the Graafian follicle, by most observers it is believed to either disappear, or be entirely transformed. By the researches of Mr. Newport, we are told that there is a partial return of the germinal vesicle towards the centre of the yolk, and, considering the germinal vesicle as a parent cell, its nuclear particles which form the germinal spot are developed into secondary cells, and so on to tertiary cells, until the germinal vesicle has been transformed into a mass of cells, which leads to the rupture and diffluence of the parent cell, or germinal vesicle. It is uncertain whether the embryo cell, or vesicle which replaces the germinal vesicle, is formed just before or after the act of fecundation.

What is peculiar in regard to the male element of impregnation? — The part of the male semen necessary to impregnation is the spermatozoa, which was thought for a long time to be animalcules, but which has been ascertained to be particles developed within the seminal cells found in the secretion of the testes before it leaves the gland. While in the cells they are in bundles, but as the fluid leaves the gland the cells are broken, and set free the spermatozoa. The spermatozoa consist of an oval, flattened body, and a tail, or filamentous portion; the body is $\frac{1}{5000}$ part of an inch, and the length of the entire *particle* $\frac{1}{400}$ to $\frac{1}{600}$ of an inch.

What is now the generally-received opinion in regard to the act of impregnation or fecundation? — That the spermatozoa penetrate the ovum, and come in positive contact with the contents of the germ cell, and that impregnation does not depend upon the penetration of one spermatozoon, but of many; and that it occurs more certainly when we have mass upon mass of spermatozoa penetrating. When the ovule is penetrated by the spermatozoa, the spermatozoa lose their motor power, and become disintegrated, after having communicated that force to the ovum which leads to the formation of the future being.

After the ovule has been converted into the ovum by fecundation, what important early phenomena are noticed? — The first change is the cleavage of the yolk; the embryo cell separates into two cells by spontaneous cleavage, and the yolk divides into two masses, and the two cells are in the centre of the two yolks, or two portions of the yolk; afterwards the cells are divided into four, and then into eight, and so on, the yolk combining with the individual cells, until the pro-

cess of segmentation is completed; and the product of the embryo cell and the yolk form together a homogeneous mass of cells, termed the germ mass, or mulberry mass, from which the whole organization of the fœtus is evolved.

What changes take place in the germ mass at this stage of development? — Those cells which are nearest the surface and under the zona pellucida, or vitellary membrane, become aggregated together at one part of the ovum, so as to form a layer, which constitutes the blastoderm, or germinal membrane.

What takes place in this membrane? — In the first instance, this membrane divides into two layers, the external, or serous, and the internal, or mucous. Afterwards, other cells of the germ mass collect between these two layers, and form the third or vascular layer. These layers are not flat, but spherical membranes, contained within the external membrane of the ovum, or the vitellary membranes. The appellations given to these layers designate the origin of the tissues of the body.

What takes place on one point of this sphere? — The membranes, by the accumulation of cells in which the rudiments of the fœtus are formed, become thickened. This dense part is called the area germinativa, at first round, then oval, and afterwards pyriform.

What occurs in the centre of the area germinitiva? — The cells of the serous or mucous layers become fewer, forming almost a transparent space, called the area pellucida, around which a margin is formed by an accumulation of cells in the vascular layer, forming the area vasculosa. In the centre of the area pellucida, and in the serous layer, the first sign of the fœtus is visible as a transparent groove, which is the primitive trace. It is surrounded by two elevated ridges, called the laminæ dorsalis. The primitive trace represents the future cerebro-spinal nervous centres, the dorsal laminæ the cranium and vertebral column; as the ridges of the laminæ dorsalis, or elevations of the serous layer, approach each other, they unite and form the spinal canal, closing the groove before described. As the upper portions of the laminæ are closing to form the vertebral, the lower portions, or laminæ ventales of Baer, prolong, to form the ribs and walls of the abdomen. The limbs, with the joints, and their fibro-serous linings, are derived from the same membrane.

How and where are the blood-vessels first formed for the fœtus? — In the vascular layer, and that part referred to as the area vasculosa, by the union of series of cells, which, upon their walls being broken down at the point of union, forms the channel; the blood disks being formed from the nuclei of the cells. The heart is formed from the same kind of cells; the bloodvessels being first formed, the current is from the bloodvessels to the punctum saliens.

How is the amnion formed, and what is its office? — On the outside of the area pellucida, and beyond the extremities of the ovum, the serous lamina projects in the form of two hollow processes, which

gradually arch over the whole fœtus, forming a double layer upon the dorsal aspect. These processes meet and unite together, and, although at first separated, they gradually approximate at the umbilicus, and surround the umbilical cord. The amnion has one layer surrounding the fœtus, and the other adherent to the maternal membranes — between these two laminæ we have the liquor amnii.

What is the situation of the mucous layer, as regards the yolk, and how are the mucous canals formed ?—It is in immediate contact with the central portion of the yolk. The mucous canals are formed by a constriction of the mucous layer on the under surface of the commencing fœtus; as this constriction increases, the smaller mucous cavity, formed from the mucous glands and membranes by re-duplication, is nearly cut off from the larger mucous cavity containing the remains of the germ cells.

What constitutes this larger cavity? — The umbilical vesicle, and, where the two cavities are separated, is afterwards the umbilicus; the umbilical vesicle affords the most nutriment to the fœtus. The umbilical vesicle now is continuous with the abdominal mucous cavity by the vitelline duct, at the umbilicus.

By what means is the material of the yolk now conveyed to the fœtus? — By the vitelline duct and vessels (the omphalo-mesenteric vessels, consisting of an artery and vein), which are developed in the parts of the mucous layer composing the walls of the umbilical vesicle.

Where do the omphalo-mesenteric vessels terminate? — In the superior mesenteric artery and vein.

What becomes of the umbilical vesicle and the vessels after they have performed their office? — They shrink up, and their remains constitute the vesicula alba.

What is the allantois? — A temporary structure formed at the lower anterior part of the embryo, apparently from a mass of cells. The cellular cavity is elongated, and afterwards divides into two cavities, communicating, the smaller of which becomes the urinary bladder. The urachus, the cord leading from the bladder to the umbilicus, is the remains of the original cord connecting the bladder and the allantois. The allantois is partially intended to receive the secretion from the kidneys, but chiefly, in the mammiferous ovum, to convey a loop of bloodvessels of the embryo to the maternal surface of the ovum, and therefore providing a permanent means for nutrition and excrementition.

PREGNANCY, ETC.

What are the two forms of pregnancy?—Uterine and extra-uterine.

What is meant by uterine pregnancy? — Where the ovum is developed in the cavity of the uterus.

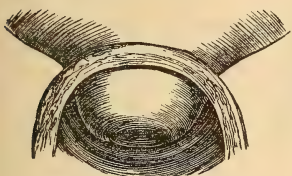
What is meant by extra-uterine pregnancy? — The development of the fecundated ovule out of the cavity of the uterus, either in the ovary, fallopian tube, or body of the uterus, &c.

What are the varieties of true pregnancy?—Simple pregnancy, where there is a single ovum; double and triple, where there are two or three ova; and complicated pregnancy, where we have a polypus, a great quantity of water, &c., present.

What is the measurement of the neck of a uterus in the unimpregnated adult female?—About an inch long, and half an inch thick.

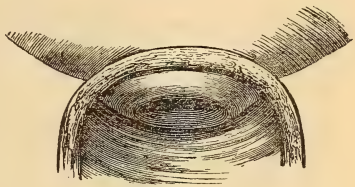
What variations take place in the neck of the uterus after impregnation? (Figs. 302, 303, 304, 305.)—During the first two months it

Fig. 302.



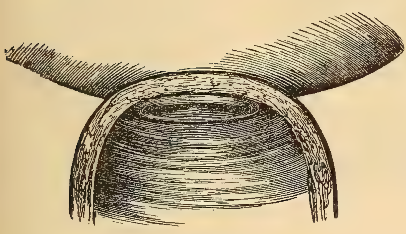
3 months.

Fig. 303.



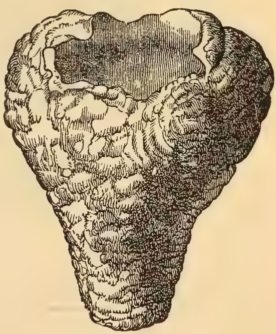
6 months.

Fig. 304.



9 months.

Fig. 305.



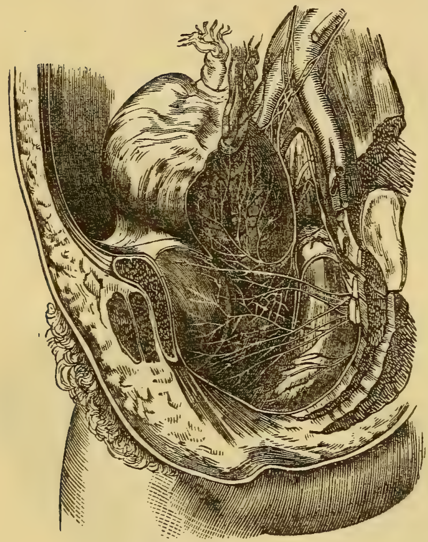
becomes thicker and longer, and it continues to become longer until the fourth month; during the fourth and fifth month it shortens from one-third to one-fifth; at the sixth month, two-thirds; at the seventh and eighth months it is almost entirely developed or passed away.

What is the state of the os uteri after impregnation?—It becomes plugged up by mucus.

What are the various changes which take place in the uterus itself?—It at first becomes more pyriform; the posterior surface then developes more rapidly than the anterior; and at the fifth month the uterus is almost spherical in form; at the third month the fundus is a little above the margin of the superior strait; at the fourth month a large part of it is out of the cavity of the pelvis; at the fifth month the fundus is half-way between the pubis and umbilicus; at the sixth

month, on a level with the umbilicus; at the seventh month, an inch or two above the umbilicus; and at the eighth month it has reached the epigastric region; at the ninth month the fundus is lower than at the eighth month, on account of the anterior development of the uterus, and its falling more forward than before.

Fig. 306



Where are the intestines forced by the development of the uterus? — Up and back.

What is the size of the uterus at the full term of utero-gestation? — Twelve inches, from the fundus to the mouth of the uterus; eight inches transversely, and nine inches antero-posteriorly.

What is the condition of the orifice of the uterus during its development? —It becomes softer, and the muscular fibres and vessels are more perfectly developed.

What are meant by the venous sinuses of the uterus? — Simply the veins much enlarged, with their orifices open upon the internal surface of the uterus.

What is the condition of the nerves of the impregnated uterus?— These, which are very small in the unimpregnated womb, become increased in size, until at the full term they form large cords, which send off numerous branches which accompany the uterine vessels, and anastomose freely. (Fig. 306).

Is the sensibility and irritability of the uterus, during pregnancy, increased? — Yes.

What is the state of the vagina during pregnancy? — During the first months it becomes shorter, and then afterwards longer and larger.

How are the fallopian tubes and ovaries situated at the end of pregnancy? — They hang along the sides of the uterus.

What effect has uterine development upon the bladder and urethra? — It carries the bladder upwards and forwards, and the urethra nearly perpendicular.

What effect has uterine development upon other parts of the system? — It impedes respiration, produces constipation, distends the

skin, leaving behind appearances of cicatrices, and frequently renders the patient nervous and irritable.

Why is there a great tendency to œdema, varicose veins, anasarca, &c., during pregnancy? — Because of pressure upon the vena cava and absorbents.

What changes take place in the cavity of the uterus at the time of impregnation? — A stimulus is imparted to the uterus to fit it for the reception of the ovum. At this time the membrana decidua is formed from the actual mucous membrane, by a process of development under the stimulus of impregnation; which, in the early part of pregnancy, consists of two principal portions, decidua vera, and reflexa, the former lining the cavity of the uterus, and the latter covering the embryo; at first these two are in contact, where the ovum rests upon the uterus.

From what is the decidua vera formed? — From the enlarged tubular glands, and the capillaries of the interglandular spaces, together with the plastic secretion.

What are the more recent opinions relative to the formation of the decidua reflexa?—According to Mr. Goodsir, the decidua reflexa is a membranous or plastic structure, formed out of the cellular secretion, derived from the mucous surface of the decidua vera. According to M. Coste, the decidua vera and reflexa are both produced from the metamorphosis of the mucous membrane; and that the ovum on entering the uterus is imbedded in a spongy mucous membrane, speedily increased in thickness at the point which receives the ovum; arising around which, they meet and envelop the ovum completely.

What is the appearance of the decidua vera and reflexa when first formed?—The decidua vera is marked by the appearance of tubular glands, and the decidua reflexa consists chiefly of cells. In the cavity of the decidua, not occupied by the ovum, we have a gelatinous fluid for the nutrition of the ovum. On the internal surface of the decidua vera it is smooth, and the surface in contact with the fibrous structure of the uterus has, according to Montgomery, small cup-like elevations, containing a whitish fluid, with mouths opening to the side of the uterus. He termed them *cotyledons.*

Does the decidua line the fallopian tubes?—Upon this point there is still doubt; but most observers say not.

What becomes of the decidua vera as the uterus is developed?—It increases with it until the adhesion of the ovum to the site of the future placenta, where it becomes prominently developed; and the decidua serotina, as the portion of the decidua vera entering into the formation of the placenta, forms the most important part of the decidual membranes. The rest of the decidua vera becomes a thin layer, lining the whole surface of the uterus, excepting at the cervix, and the angles where the fallopian tubes enter.

Does there not exist a cavity between the decidua vera and reflexa, till the latter period of gestation? — Yes, beyond the middle. The

external surface of the decidua reflexa, and the internal surface of the vera become so smooth, that they look like serous membranes; and as pregnancy advances, and the ovum fills the cavity of the uterus, the two decidual surfaces are brought in juxtaposition, so that they can scarcely be separated.

What takes place at labour?—The decidua reflexa, the amnion and the chorion are thrown off with the placenta, while the decidua vera passes off with the lochia, &c.

What is the chorion?—An envelop which the fœtus derives from the mother, and is formed before the ovum enters the uterus. It is internal to the decidua. When the ovule escapes from the ovisac, it is surrounded by part of the granular matter, forming the proligenous disc. After fecundation, and as the ovum is passing down the fallopian tubes it acquires an albuminous layer, which becomes adherent to the vitellary membrane, or the outer covering proper of the ovule, and which is the commencement of the chorion. This albuminous chorion is at first a source of nourishment to the ovum, but it soon becomes changed into an absorbent organ, drawing nourishment from the decidua and decidual cavity. It is uncertain whether the chorion is formed in whole or in part, before or after fecundation.

What are the changes which the chorion undergoes?—When first formed externally it is smooth, but in the earlier state, as seen in the uterus, it has been found covered with villi; each villus being bulbous in shape, covered by a membrane containing cells, which are the chief agents in absorption. These villi at first present no blood-vessels, but draw nourishment by endosmosis from the elements with which they are in contact. Afterwards when the allantois, with the umbilical artery and vein, have approached the chorion, the villi contain vessels, which are concerned in the nutrition and growth of the fœtus. In the second month the villi are of considerable size, and their cellular cavities communicate freely with each other over the whole surface of the chorion. After the second month they diminish in size from below upwards, excepting at the site of the placenta, until the whole unattached surface of the decidua reflexa and chorion become smooth. By the end of the fourth month, the villi of the chorion on the placental side disappear. The villi of the chorion do not become developed into the villi of the placenta, but form the most internal portion of these villi.

How is the placenta formed?—We have before noticed the allantois conveying what is to be the future umbilical vessels towards the surface of the ovum. At the same time the decidua vera and reflexa are acquiring thickness at the point to which the allantois is conveying the vessels, and we have at the same spot a development of the villi of the chorion; these elements go to form the future placenta.

How are the chorion, decidua, and maternal and fœtal vessels arranged in the placenta?—The villi of the chorion, capped by a layer derived from the decidua, form the villi of the placenta.

On the maternal side the vessels of the placenta consist of arteries and veins, with a series of cavernous cells between them. On the fœtal side, the vessels consist of branches of the umbilical arteries and vein, with the large capillary vessels of the villi of the placenta between the two. The maternal portion of the placenta is formed by the decidua serotina, the arteries and veins which enter the decidua from the uterus, the cavernous structure of the placenta, the blood circulating in these vessels, and the external microscopic layer of cells covering the placental villi. The fœtal portion of the placenta is formed of the chorion and its villi, the latter forming the internal portion of the placental villi, and of ramifications of the umbilical arteries and veins. In the process of the placental formation the chorion and decidua first become applied to each other. We have pointed out the development of the uterine vascular system on the maternal side. On the fœtal side, as said also, the allantois projects the future vessels to the chorion, and in the chorion a vascular system is developed which, together with the umbilical vessels, constitute the fœtal portion of the vessels of the placenta.

Upon the examination of the simple villus, is not the whole arrangement by which the intimate connection with and yet perfect separation between the maternal and fœtal circulations of the placenta, together with the mode of nourishment of the fœtus after the formation of the placenta, fully described? — Yes; each villus being composed of a bloodvessel, a layer of cells, and a fine membrane, derived from the chorion; of a second layer of cells, and a second membrane, derived from the decidua, with a small cavity between the two; the whole of these structures being inclosed in the blood membrane of the mother. Thus formed, the villi lie in and are bathed by the maternal blood; and the maternal blood represents the atmospheric air, and the vessels of the villi the pulmonary capillaries, which belong to the fœtal portions of the placenta. By these means the placenta plays the part of the lungs for the fœtus.

Is the pulmonic function the only one of importance performed by it for the nutrition of the fœtus?—No; it also performs those of the intestinal canal. The cell-layers derived from the decidua and chorion, and the vessels of the villi, are analogous in function with the cells and lacteals of the villi of the intestinal canal.

How large is the ovum when it passes from the ovary to the uterus? About the size of a small pea.

What is the character of the liquor amnii? — It is a saltish, unctuous fluid, thicker than water, and of a brownish colour.

How much is there generally at the birth of a child? — It varies from a pint to a quart or gallon.

What is the apparent use of this fluid? — To allow free motion to the child, and to prevent its being injured by jars, &c.

How is the embryo connected to the placenta? — By the umbilical cord.

Of what is the umbilical cord composed?—Of two arteries, a vein, absorbents, a covering of the amnion and albuminous matter.

What is the size of the placenta?—Six to eight inches in diameter; its circumference eighteen to twenty-four; and its thickness varies.

What becomes of the fœtal blood after it has circulated through the umbilical arteries? — It is returned by the umbilical vein.

Is the placenta easily detached from the uterus? — Yes.

What is the usual length of the umbilical cord? — From eighteen to twenty inches.

What is the difficulty attending a too long cord? — It is liable to become knotted, and to prolapse during labour.

What is the difficulty when the cord is too short? — It may retard delivery, or the placenta may be detached too soon, or the uterus may be inverted.

Are there any valves in the veins of the cord? — No.

How are the membranes situated in case of twins? — Each embryo has its own membranes and its own placenta generally.

What opinion is most prevalent in regard to superfœtation?—That it would be impossible to take place while the uterus is occupied by a decidua, or perhaps an ovum, but that before that time it can occur.

What is the probable cause of a female giving birth to twins of different sizes, and apparently different ages? — That it was probably a twin pregnancy; but that the one fœtus has ceased to be developed.

Where is the placenta mostly situated? — On one of the sides of the uterus, near the fallopian tube.

How long do we call the new being an embryo? — During the first three months; after this time it is called fœtus.

How soon can an embryo be seen within its investments? — About the tenth day, by means of the microscope; it is then a small speck.

FŒTUS, ETC.

What is meant by the vitability of the fœtus? — That the fœtus is able to exercise an extra-uterine life.

When does this occur? — At the end of the sixth or beginning of the seventh month.

What is the situation of the fœtus in the cavity of the uterus at the full period of gestation? (Fig. 307) — in the form of an ellipse, with the limbs crossed and flexed in front of the abdomen.

Which is the long diameter of the fœtus, and how much is it? — From vertex to coccyx; and it is about twelve inches.

What is the weight of the fœtus at full term generally? — From seven to eight pounds.

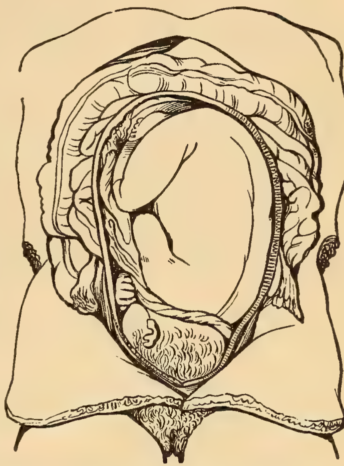
What is the size and weight of each child in twin pregnancy? — They are smaller and of less weight than at a single pregnancy.

Where is the umbilical cord situated at full term? — Midway between the pubis and lower portion of the sternum.

What is the condition of the fœtal brain? — It is soft and flabby.

What are the relative sizes of the different visceral organs of the fœtus? — The liver is quite large and the lungs small, and very slightly porous or crepitous; the rest of the viscera are small.

Fig. 307.



What gland have we in the fœtus which is absent in the adult? — The thymous gland, situated in the top of the superior mediastinum; it has two lobes.

What is peculiar to the fœtal heart? — It is like a single heart; the two auricles acting as a single auricle, and both the ventricles acting as a single ventricle.

What is peculiar to the septum between the auricles? — It is incomplete, having an orifice called the foramen ovale.

Do we not have something like a valve at this foramen? — Yes, upon the left side of the foramen ovale.

Describe the fœtal circulation.—The blood enters the fœtus through the umbilicus by the umbilical vein; this vein passes underneath the edge of the liver and empties into the left branch of the sinus venæ portarum, whence part of the blood is distributed to the lobes of the liver; the other part is conducted by the ductus venosus into the left hepatic vein, which empties itself into the ascending vena cava, which empties itself into the right auricle of the heart; a part of which blood passes through the foramen ovale into the left auricle, the other part into the right ventricle. From the right ventricle the blood is forced — a small quantity through the pulmonary artery, while a much larger portion passes by the ductus arteriosus into the aorta. The blood from the left ventricle is forced through the aorta simultaneously by the contraction of the right ventricle. The blood from the ductus arteriosus and the aorta, being mixed, passes through the aorta to the iliacs, where two branches are given off, which mount up along the sides of the bladder, and pass out at the umbilicus to the placenta.

Where is the situation of the ductus arteriosus? — It arises from the pulmonary artery just as it is given off from the heart, and passes to the aorta just below its arch.

What peculiar changes take place in the system upon the birth of the child? — Respiration takes place; the blood passes through the pulmonary artery to the lungs, and the ductus arteriosus gradually

becomes obliterated; the valve between the two auricles becomes closed, and the usual circulation of the adult system takes place; and the other vessels of uterine life become obliterated.

Does the fœtus make its own blood? — Yes.

What is the colour of the fœtal blood? — It is between the colour of arterial and venous blood, with a softer coagulum and with smaller globules.

What are some of the proofs that the maternal blood is not circulated in the fœtus? — Because injections cannot pass from the vessels of the mother to the fœtus, and *vice versâ;* and that hemorrhage from the umbilical cord, when cut at birth, is not continuous, but exists only for a short time, &c. The fœtus may die from rupture of the cord, but the mother does not suffer, &c.

May not a fœtus suffer from a continual drain of blood from the mother? — Yes.

How is the ratio of pulsations in the fœtal heart in comparison with that of the mother? — They are two to one as frequent as in the mother.

How does pressure upon the cord produce death in the fœtus? — By interrupting the process of hematosis, and by suspending the circulation, and also nutrition.

Is it probable that the liquor amnii affords nutriment to the child? — No.

Is it probable that the fœtus has sensation while in the uterus? — Yes, to a slight degree.

EXTRA-UTERINE PREGNANCY.

What are the varieties of this? — Ovarian pregnancy, where the embryo is developed in the ovary; abdominal pregnancy, where the embryo is developed in the cavity of the abdomen; and tubal, where it is developed in the fallopian tubes; and interstitial pregnancy, where the embryo is developed in the walls of the uterus.

Can we give any positive reasons for these irregularities in pregnancy? — No.

For how long a time may the ovum continue to be developed in these cases? — For two or three months, and be surrounded by a peculiar cyst or sac.

Does decomposition readily occur in these cases? — No.

What is the condition of the cavity of the uterus in these cases? — It is frequently lined by a species of decidua.

In some extraordinary cases have not women carried a fœtus in this extra-uterine state for many years? — Yes.

May not women become pregnant in the usual way while carrying a child in this extra-uterine state? — Yes.

What can be done in these cases of extra-uterine pregnancy? — Very little but palliate symptoms.

Has gastrotomy been advised in some of these cases? — Yes.

OF THE SIGNS AND DISEASES OF PREGNANCY.

How do you divide the signs of pregnancy?—Into rational and physical.

What is the first rational sign?—The suppression of the menses.

Is this a positive sign?—No.

Are the menses always interrupted in pregnancy?—Not always during the first months.

Do women ever menstruate during pregnancy, and do they not sometimes menstruate only during pregnancy?—Yes; they may do both.

Do not the mammary glands becomes sympathetically affected in pregnancy?—Yes.

At what time do the mammæ begin to secrete milk?—Towards the end of pregnancy, or during the latter part of the eighth month.

May not milk be found sometimes in the breasts of females not pregnant or nursing?—Yes

Do not the breasts sometimes become tumid and painful from other causes than pregnancy?—Yes.

What changes occur in the nipples, and in the areola of the mammæ?—The nipples become enlarged, tumid, and dark-coloured; the areola become larger and darker, and the follicles around the nipple are enlarged.

May not all these changes arise from uterine irritation, &c.?—Yes.

What are the changes in the uterus in the early months of pregnancy?—It enlarges and is developed; and from the third to the fourth month a small tumour may be felt in the abdomen.

During the first two months of pregnancy can the uterine tumour be felt?—No; the uterus sinks during this time down in the cavity of the pelvis.

Where is the top of the uterus at the fourth month?—Just above the superior strait, &c. [See, for further development of the uterus, pages 637—8].

Do we always have pouting of the naval at pregnancy?—No.

Is not the carriage of the female changed by pregnancy?—Yes; it becomes more vacillating, and the limbs are stretched further apart in standing or walking.

What sign has lately been discovered which has been thought to be of great value?—That of kiestine in the urine.

What is meant by physical examination in pregnancy?—By an examination with the hand upon the external surface of the abdomen; that *per vaginam;* and by auscultation, &c.

When the hand is placed cold upon the parietes of the abdomen, may we not sometimes feel the fœtus move?—Yes.

How should the female be placed to allow this examination?—Upon the back, with the body flexed, and the whole body in a relaxed state.

What is meant by the touch?—An examination *per vaginam.*

What arrangements are necessary when this examination is to be

made with the patient lying down?—The proposition should be made to a third person; the room should be darkened, and the female suitably clad and situated, and the examiner should take his seat so that his right hand may be towards the hips of the patient (if on the left side and horizontal), but if on her back he should sit with his face towards her.

If the patient is standing, how should she and the examiner be situated? — She should stand against something firm, and slightly recline upon the shoulders of the examiner; the examiner should be seated upon a low seat, or bend upon his knee in front of the patient, and pass his index finger to the posterior commissure of the vulva.

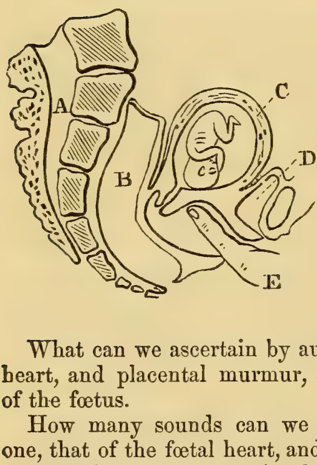
Is not the touch an excellent mode of diagnosticating pregnancy? — Yes.

How soon may we rely upon this to aid us indiagnosticating pregnancy — After the fourth month.

Can we ascertain that the body is really a fœtus? — No; but we can ascertain the fact of something floating in a fluid in the uterus.

What name has been given to this? (Fig. 308.) — *Ballottement* or uterine palpitation or percussion.

Fig. 308.



How is this performed? — By placing the index finger of the one hand upon the mouth of the uterus, and the other hand upon the body outside, then making a slight percussion, and waiting for the rebound.

Does the woman usually experience a tremulous sensation in the womb at the end of the fourth month? — Yes.

When does the uterus arise out of the cavity of the pelvis? — Between the fourth and fifth months.

May not all these signs of pregnancy fail? — Yes.

What can we ascertain by auscultation? — The action of the fœtal heart, and placental murmur, and hence the vitality or non-vitality of the fœtus.

How many sounds can we discriminate by auscultation? — Two; one, that of the fœtal heart, and the other of the placental circulation.

What is the difference in these sounds? — The first has a quick, double beat, and the other is synchronous with the maternal heart.

What is there peculiar in the placental sound? — It is cooing (but this is doubted).

Must we rely entirely upon the sounds in determining whether there is life or not?—No; for the placenta may be placed far back in the uterus; or the child may be situated with its back at a distance from the abdominal parietes, so that we cannot hear them.

Where are the sounds usually heard? — At the lower and lateral portions of the uterine tumour.

Into how many classes may we divide the diseases of pregnancy? — Into two; local and general.

What are some of the local signs?—A difficulty or a frequency in passing urine, from the pressure of the uterus upon the bladder; a frequent disposition to defecate, or a constipated state of the bowels; or great irritation in the rectum, from pressure of the uterus. We have, also, pain in the right side, dyspeptic symptoms, from pressure upon the stomach; hernia, from pressure on the bowels or bladder, &c.

What is the effect of pressure upon the large blood-vessels? — It produces œdema of the lower extremities, congestion of the inferior vessels, hemorrhoids, &c.

What effect has pressure upon the nerves of the lower extremities? — It produces cramp, spasm, and neuralgia.

What influence is sometimes exerted over the vagina?—It becomes turgid and full, very hot, and often we have a leucorrhœal discharge, aphthæ, and pruritis vulvæ, with a violet colour of the mucous membrane.

Is not the skin put upon a great stretch, and rendered painful? — Yes.

Does not the stomach often become nauseated, and vomiting occur? — Yes.

When does this nausea generally occur?—Upon rising from bed in the morning, and hence is called morning sickness; but it may last all day.

What effect is sometimes produced upon the stomach? — Its taste becomes depraved, and the patient has a longing for *outre* articles.

When do these feelings arise, and how long do they last? — They arise, generally, as soon as menstruation has ceased, and during the first month, and continue for two or three months.

Are we generally to fear anything from this sickness of the stomach? — No; not unless long-continued and severe.

By what may these disagreeable feelings of the stomach be relieved? — By taking food, rest, fresh air, and slight cordials.

Is not the liver sometimes implicated? — Yes; and we then may have maculæ or slight jaundice, high-coloured urine, &c.

What effect is produced upon the salivary glands? — They become irritated, and we have a profuse discharge of saliva.

What name has been given to that state of the mammary glands which sometimes exists beyond the ordinary excitement?—Mastodynia.

What are some of the general symptoms of pregnancy? — Excitement of the brain, the cerebro-spinal system of nerves, and of the vascular system.

What are some of the signs of cerebro-spinal irritation? — We may have great despondency, vitiated sensibility, hysteria, dyspnœa, palpi-

tation, great irritability of the uterus, with nervous chills; or we may have fainting, &c.

Are some females troubled with otalgia, odontalgia, cephalalgia, &c., during pregnancy? — Yes.

What effect is exerted upon the vascular system? — It becomes greatly increased in blood, and we have general fulness and turgescence, and congestion, causing headache, &c.

What evil consequences may arise from this state of the system? — We may have apoplexy, hemorrhage from the uterus, &c.

How would you meet these symptoms? — By fresh air, regulated diet, slightly aperient medicines, and often by bleeding; administer slight cordials, &c.

How would you relieve many of the other symptoms of pregnancy? — By correct hygienic treatment, and judicious medical applications.

What should be the character of the diet of a pregnant female? — It should be light, and easy of digestion; and her drinks should be simple, and in moderate quantities.

How can we remove plethora? — By gentle and easy exercise, with proper regard to food and drink; and sometimes it is necessary to resort to venesection.

How would you counteract nervous irritation? — By slight febrifuges, cordials, and antispasmodics.

In what way is it sometimes necessary to remove impacted fæces from the rectum? — By mild injections, or by the finger or spoon-handle.

How would you treat any inflammations or mechanical obstructions about the patient? — By the usual means, always bearing in mind the condition of the individual.

Is puncturing ever necessary in œdema, or general dropsy? — Yes; but it should be done with caution.

What is necessary in morning sickness? — To eat before arising, and to use mostly solid food; and if sickness should recur, to lie down again.

If vomiting should occur, how would you relieve it? — By antacids, and some aromatic infusion. In a case of excessive nausea and vomiting, after every other means failed, strychnine in small doses was resorted to with complete success.

What is necessary in mastodynia? — The use of warm anodyne applications, and sometimes leeches to the breasts, or the use of the soap plaster.

In cases of severe toothache, should we not be cautious in the extraction of teeth? — Yes.

LABOUR, ETC.

What is meant by labour? — The action both of the uterus itself and the powers of the system generally, necessary to cause the birth of a child.

How do we calculate the period for natural labour? — Ten days from the last menstrual period. Nine calendar months and ten days, or ten lunar months, or two hundred and eight days from the last appearance of the menses.

Do not some females go longer than this? — Yes.

What are the two varieties of labour? — Natural and accidental.

What are some of the causes of accidental labour?—Any untoward circumstances which may affect either the mind or body of the mother.

What is the prime agent in labour? — The uterus.

Does not the action of the mind influence the progress of labour? —Yes, to a partial degree.

When the brain and spinal marrow become unduly excited, what may we fear? — Convulsions.

What are the varieties of uterine contraction? — The tónic and spasmodic.

What is a tonic contraction? —Where all the uterine fibres become unusually rigid.

What are spasmodic contractions? — The alternate contractions, or those coming and going, or labour-pains.

What is the usual frequency of the labour-pains? — At first they occur every half hour, but afterwards they become more frequent, as every ten or fifteen minutes.

What is the effect of these contractions? — They at first dilate the orifice of the uterus, and afterwards force the child down.

What happens to the membranes in these contractions?—They are separated from their attachments to the uterus.

How is the bag of waters formed? — By the contractions of the uterus forcing the membranes through the mouth of the uterus, the liquor amnii and the head of the child being at the same time forced down.

What is the state of the vagina under the pressure from the bag of waters? — It becomes enlarged and lubricated with mucus.

What happens to the bag of waters under repeated uterine contractions? — It bursts, and the liquor amnii is discharged.

Does the bag of waters always form? — No; for the membranes may be prematurely ruptured, or the head of the child may be firmly forced against the uterine orifice.

When the waters have passed away, upon what does the uterus then act? — Upon the fœtus.

What accessory powers are now brought to bear? — The abdominal muscles; and these sometimes may excite the uterus to increased action.

What are some of the signs that labour is about to commence? — The subsidence of the abdominal tumour; pressure or uneasiness at the lower portion of the abdomen; a secretion, muco-albuminous-like in character, also takes place, with a softening and general relaxing of the tissues of the vagina, &c.

How do we divide the stages of labour? — Into the first stage,

or that of dilatation of the os uteri; the second, or expulsion of the child; the third, or that of the expulsion of the placenta and membranes.

Where are the first labour-pains usually felt? — In the back or the hypogastric region.

What is the moral and physical condition of the female at labour? — She is generally irritable, petulent, desponding; she is often chilly and nauseated; the pulse is small and feeble, and the vagina secretes a muco-sanguineous discharge.

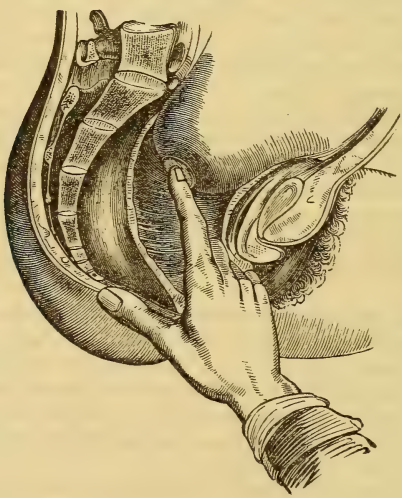
What is this muco-sanguineous discharge called in common language? —A show.

May not a female have feigned pains? — Yes.

In what manner does the orifice of the uterus dilate? — At first slowly, but afterwards more rapidly.

How would you ascertain the degree of dilatation at each pain? (Fig. 309.) — By the application of the finger to the os uteri during a pain.

Fig. 309.



What are the usual periods occupied for each stage? — The first stage is from six to twelve hours; the second, from three to five hours, and the last from one to two hours.

Which are the more dangerous stages to the mother and child? — The second stage is more dangerous to the child, and the third stage to the mother.

What is the description of the pains in the first and second stages of labour? — Those of the first stage are cutting and grinding; the second are more forcing, or bearing down.

What are the positions which the female should assume during the stages of labour? — That which is most easy for her during the first stage; and during the succeeding stages she should be placed in bed.

What is the condition of the female, generally, during the second stage? — Her pulse becomes excited; her skin is covered by a cool perspiration; the cerebral organs may become congested; her mind is more calm; her limbs may become cramped.

If the patient should feel like rising to evacuate her bowels during the second stage, should she be permitted to do it? — No; for the pressure of the child's head may produce this feeling.

Is not the perineum sometimes greatly distended? — Yes.

What is the condition of the patient after the child is born?—The uterine pains subside, and she is quite easy.

How is the placenta expelled from the vagina?—By the voluntary efforts of the mother; or else through the assistance of the accoucheur by traction.

Is there much hemorrhage attending the expulsion of the placenta? — No; it is generally about a pint.

If the hemorrhage is profuse, in how short a time may the mother bleed to death? — Some say in five or six minutes.

Whence does the hemorrhage come? — From the patulous orifices of the veins where the placenta has been attached.

What is meant by a tedious labour?—One which occupies tweuty-four or more hours.

What are some of the causes of tedious labour? — Rigidity of the soft parts; small size of the pelvis; or deviated positions of the child; or irregular contractions of the uterus.

What is meant by the term presentation?—When some portion of the fœtus is placed at the orifice of the uterus.

What is meant by the position of the fœtus? — When some particular part of a presentation is situated at a particular portion of the pelvis.

How are natural labours classified? — Into those where the vertex presents favourably, and those where the breech presents favourably.

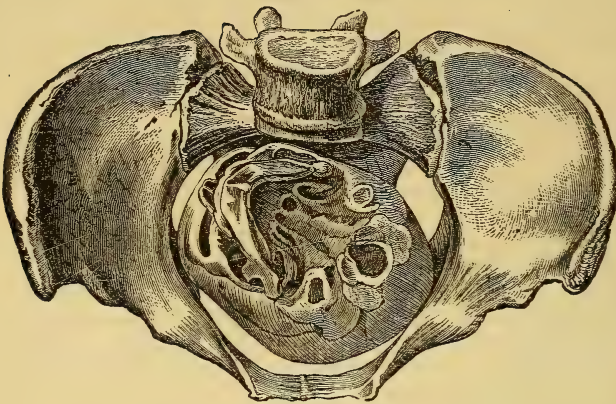
CEPHALIC PRESENTATIONS.

What are the two principal occipital presentations? — Where the occiput presents to the anterior half of the pelvis, or to the posterior half.

What are the positions of the head recognised? (Figs. 310, 311, p. 652; 312, 313, p. 653; 314, 315, p. 654.) — Six; three anterior, and three posterior.

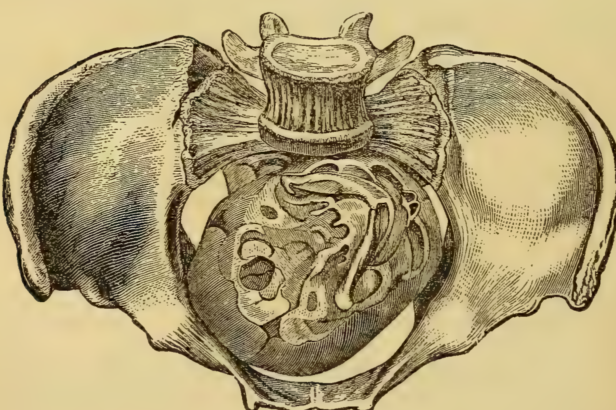
What are the various positions?—The first, where the nape of the child's neck is behind the left acetabulum, and the bregma to the right sacro-iliac symphysis; the second, where the nape of the neck is behind the right acetabulum, and the bregma to the left sacro-iliac

Fig. 310



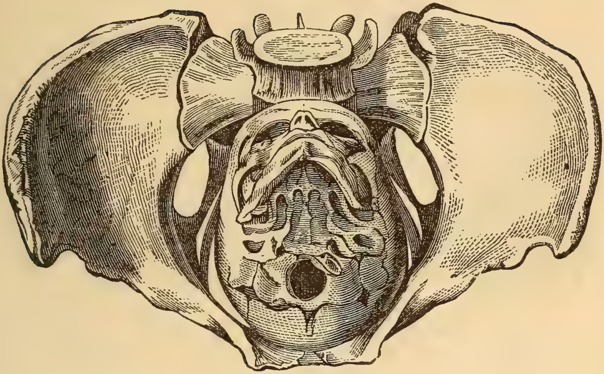
symphysis; the third, where the nape of the neck is behind the symphysis pubis, and the bregma to the sacrum; the fourth, where the nape of the neck is in front of the right sacro-iliac symphysis, and the bregma to the left acetabulum; the fifth, where the nape of the

Fig. 311.



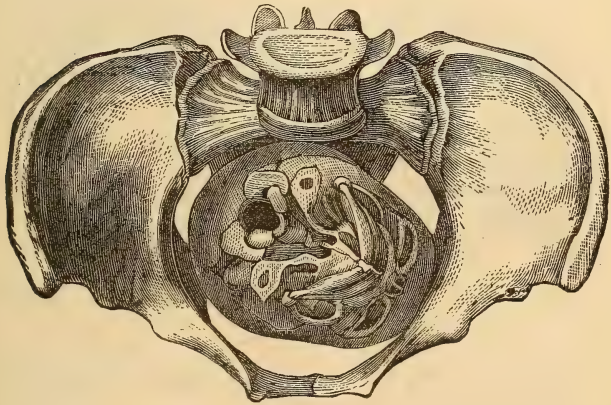
neck is in front of the left sacro-iliac symphysis, and the bregma behind the right acetabulum; and the sixth, where the nape of the neck is in front of the sacrum, and the bregma behind the symphysis pubis.

Fig. 312.



When these positions exist, what is the mechanism of labour?—First, the forcing of the child down, and flexion of the head; the head of the child then revolves, and is brought under the arch of the pubis, or rotation; it is still further forced along to the inferior strait, when the head begins to leave the breast and mount up, or extension.

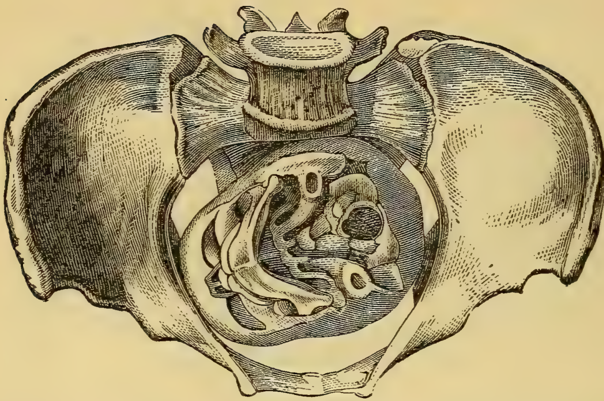
Fig. 313.



After the head is born it assumes a relative position to the body which it held in the uterus before the usual variations had taken place, or restitution.

When does the perineum become greatly distended?—When the head is in the inferior strait of the pelvis.

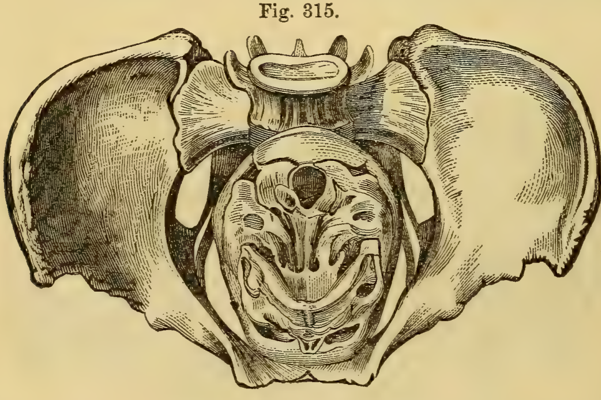
Fig. 314.



What are the changes which the shoulders undergo?—They rotate on the inclined planes; and one of the shoulders passes under the symphysis pubis and the other upon the sacrum.

What is the position of the axis of the body of the child as the

Fig. 315.



shoulders escape? — The body curves laterally to accommodate it to the curvature of the axis of the pelvis.

What are the parts of the child which offer the greatest resistance in cephalic presentations? — First the head, and then the shoulders.

Which shoulder generally emerges first? — The pubal, or, where there is great rigidity of the mother's soft parts, the sacral shoulder.

Do the same diameters of the child's head present in the first and second positions? — Yes.

What causes prevent as easy delivery in the second as in the first position? — The rectum sometimes being loaded with fæces prevents easy rotation.

Where is the occiput situated when restitution has taken place in the second position? — To the right side.

What are the difficulties in the third position? — The long diameters of the child's head present to the short diameters of the pelvis, and we have no rotation.

What is the mechanism of labour in the fourth position? — First, we have flexion; the occiput rotates upon the right posterior inclined plane, and we have greater flexion, until the forehead is thrown behind the arch of the pubis, and extension is delayed until the occiput has passed the whole arch of the sacrum, and the forehead has passed under the arch of the pubis.

Are not the thorax and shoulders greatly flexed? — Yes.

What must we guard against in this position? — Rupture of the perineum, and great pressure upon the neck of the bladder. (This latter may happen in all posterior occipital positions.)

What motion does the head perform after it is delivered in these occipito-posterior positions? — Revolution backwards.

What is the mechanism of the fifth position? — The same as in the fourth, bearing in mind the difference of the inclined planes, &c.

Which is the most rare of all the positions? — The sixth.

What is its mechanism? — The head of the child is forced directly down without rotation; and the same changes occur as in the third position, only remembering that the forehead is in the same position as the occiput was in the third position.

Which two positions give a good study for the general principles of the mechanism of labour? — The first and fourth.

Why may deviated positions of the child's head, or the fourth and fifth positions, be converted into the second and first? — Because of the greater breadth of the anterior inclined planes.

What treatment should be directed in the latter stages of pregnancy? — A proper degree of exercise, vegetable diet, simple drinks, avoid constipation, and promote the secretion and excretion of urine.

What kind of a room should the patient select for her apartment during confinement? — A spacious and well ventilated one.

What would you advise in regard to the bed? — That it be placed so as to be accessible from all sides; and with posts so high, as to enable the patient to place her feet against them with ease; and that it be well ventilated.

Is there any danger attending the delivering her upon the bed, and transferring her to another? — Yes; from hemorrhage occurring to the woman.

How would you prepare the bed for delivery? — Let the bed be made as smooth as possible; place, where the hips are to rest after

delivery, a folded blanket, oil cloth, &c., to protect the bed from the lochia. Then place upon the bed, at its lower portion, another piece of oil-cloth, flannel, &c., where the woman is to rest while being delivered, to prevent the discharges from running down or soaking the bed. Now place at the upper portion of the bed a sheet drawn up in folds, which may be drawn down when the woman is put up in bed, after she is delivered; throw another sheet over the foot of the bed, and hanging down over the edge of the bed where the accoucheur is to sit; then place the pillows diagonally near the right foot-post (as regards the accoucheur), attach a band to this post, that she may draw upon it when in labour.

What is the best position for delivering? — Upon the left side, and the axis of the body inclined to nearly the same axis as that of the uterus.

What is the preparation necessary for the patient to be put to bed? — Her body-clothing may be so placed as not to be soiled; her petticoats should be put aside; her chemise should be rolled up around her waist; the bandage to be used after delivery should be pinned close to the rolled-up chemise. A sheet should now be placed around her body; her bed-gown may be put on; and she may now be placed in the bed, and covered by the usual bed-clothes, &c.

What should be at hand when the child is born? — A ligature for the umbilical cord, a pair of sharp scissors with blunt ends, and a blanket in which to envelope the child, some warm water to immerse the child, and stimulants to excite respiration, if necessary.

What is necessary for the accoucheur?—Unctuous matter to anoint his hands, napkins, and a covering to his lap, &c.

How would you favour relaxation of the os uteri and peritonium when necessary? — By warm enemata, by bleeding, by nauseants, anæsthetics, and by warm, moist cloths against the vulva and perineum, and lubricating the os tincæ with the unguentum belladonnæ.

Should not the bowels and bladder be guarded and attended to when in labour? — Yes.

What are the dangers of too speedy bearing down? — Too early rupture of the membranes, and fatal compression of the child.

How would you distinguish true from false pains? — From the fact that the real pains are alternate; while those arising from other causes are either irregular or continual.

How would you relieve false pains?—By any of the anodyne remedies proper under other circumstances.

What is the condition of the os uteri in labour? — Slightly dilated or dilatable, and becoming rigid under a pain.

When is it necessary to put a woman to bed? — When the os uteri is nearly or entirely dilated.

How should the examination per vaginam be made? — The practitioner should be seated with his right arm to the woman's back. After lubricating the index finger, he should pass it gradually along the

back of the woman's thighs to the posterior commissure of the vulva, and insinuate his finger between the labia and into the vagina, without, in the least, exposing her person; and this should be done during a pain, so as to form a true diagnosis, if possible, if labour has commenced or not, the degree of dilatation of the os uteri, and the presentation of the child.

Can you easily diagnosticate the presentation of the child previous to the rupture of the membranes? — Yes.

Can the position as easily be recognised through the membranes? — No.

Does labour progress with equal rapidity after as before the rupture of the membranes? — It generally proceeds with greater rapidity after the rupture of the membranes, when the os uteri is dilated.

How would you rupture the membranes, if necessary?—By pressing the point of the finger into the fold of the membranes, or scraping the edge of the finger nail against the membranes; or by hooking the membrane with the fore-finger nail; or by puncturing with the point of a scissors or sharp instrument carried along the index finger.

When would you rupture the membranes? — During a pain.

How would you avoid being soiled by the liquor amnii? —By having the arms covered with napkins, and a napkin close at hand to press against the vulva when you burst the membranes; the latter also renders the woman more comfortable.

Should the accoucheur interfere during the second stage of labour if everything is proceeding naturally? — No.

How would you increase flexion of the head, if necessary? — By applying the finger against the side of the forehead, and pushing it up.

At what stage of labour should the patient bear down? — During the second stage, when the os uteri is well dilated.

Should the female bear down when the pain has gone off? — No.

How would you favour rotation of the head? — Either by pressing with the index finger upon the parietal protuberance, from behind forward; or by pressing with the index finger from below backwards (making the change of hands to adapt them to the various positions).

How would you support the perineum to prevent rupture? — By applying the palm of the hand over the perineum, with the wrist to the child's head, or by pressing with the points of the fingers against the perineum, covered with a napkin.

Must you ever retard the progress of the child's head?—Yes, when the perineum is not well dilated.

When is the time at which the perineum is most in danger? — When the parietal protuberances are passing the vulva.

What must be done when the child's head is born? — See that the cord is not twisted around the child's neck, and support the head when born on the palm of the hand.

Do you ever assist rotation of the shoulders? — Yes; by pressing the one to the pubis, and the other to the sacrum.

May we ever make traction on the head? — Yes; when the perineum is resisting; and then drawing either forward or backward, as it may be necessary for either shoulder.

Is it proper to favour the quick delivery of the body of the child? — No; it should be held back a little to allow the uterus to contract upon it.

What disposition should be made of the body of the child when it is born?—It should be so placed as to protect its face from the discharges of the mother.

What must be our chief care as soon as the child is born? — That the uterus is well contracted.

How is this best done? — By placing the hand upon the abdomen of the mother, and by grasping the uterus, and forcing it, if necessary, to contract by friction, cold applications, &c.

Must we attempt to convert a third, into a first or second position of the vertex? — Yes.

How would you assist flexion in this case? — By passing the finger of the right hand upon the occiput and pulling it down; or by pressing with two fingers on each side of the frontal bone, and pressing it back and up.

Is it ever necessary to pass the whole hand into the cavity of the pelvis, and carry up the head, and then make the change? — Yes.

Do transverse positions ever occur?—Yes; but rarely.

Where lies the greatest difficulty in occipito-posterior positions? — The want of perfect flexion of the head.

How would you favour flexion? — By pressing the finger against the forehead, or by hooking the occiput forward through the rectum, if you cannot do it through the vagina.

Have we not great reason to fear rupture of the perineum in these cases? — Yes.

How can the fourth position be converted into the second? — By pressing against the pubic side of the face, or by drawing upon the sacral side of the occiput by the fingers.

How would you change a fifth position into a first? — By pressing against the face or temple, or by drawing upon the sacral side of the occiput.

Into what positions should you convert the sixth? — Either into the fourth or fifth.

Where should we find the fundus of the uterus after delivery? — In the umbilical or hypogastric region, or just above the brim of the pelvis.

Is the placenta, in a majority of instances, spontaneously delivered? — Yes.

Must we not sometimes stimulate the uterus to contract upon the placenta? — Yes, by friction.

What is the danger of making undue traction upon the cord?—Inversion of the uterus, hemorrhage, &c., and breaking the cord.

When it is necessary to act upon the cord or placenta, in which way should you make traction?—In the direction of the axis of the pelvis.

What manœuvre is sometimes necessary to effect this?—To make a pulley of the index finger of the left hand, and draw the cord under it with the right hand.

When the placenta is down in the cavity of the pelvis, is it ever necessary to hook the finger into the placenta and draw it out?—Yes.

How would you secure the membranes?—By twisting the membranes like a rope, as the placenta passes out of the vulva.

What is necessary in inertia of the uterus?—First, to make friction over the abdomen, or grasp the uterus in the hand through the abdominal parietes; or use ergot; or pass the hand into the cavity of the uterus; or by squeezing a lemon in the cavity of the uterus, or the application of ice.

Does not the external and internal os uteri frequently contract without the uterus itself contracting; and what is the danger in these cases?—Yes; and then we may have concealed hemorrhage.

Should you ever leave your patient without the placenta being delivered?—No.

Is it ever necessary to pass the whole hand into the cavity of the uterus and grasp the placenta, and then let the uterus act upon the hand, and expel the hand and placenta together?—Yes.

What instruments are sometimes necessary to deliver the placenta?—Dewees's hook, Bond's placental forceps, and Hodge's forceps.

How would you overcome constriction of the os uteri?—By the gradual insertion of the fingers, and of the whole hand; sometimes venesection must be resorted to, or by anointing the os uteri with the ointment of belladonna, or by the careful use of anæsthetics.

May we not have constriction of other portions of the uterus?—Yes, especially of the middle portion of the uterus, producing hour-glass contraction of the uterus.

Is there not much pain attending hour-glass contraction of the uterus?—Yes.

How would you overcome hour-glass contraction of the uterus?—Induce the fundus of the uterus to contract by frictions upon the uterus through the parietes of the abdomen, and pass the hand conically through the constricted portion of the uterus, and gradually dilate it.

What must be done if this does not succeed?—Bleed the patient, and use the warm bath, opiates, and anæsthetics.

Is adhesion of the placenta to the side of the uterus a common occurrence?—No.

What must be done when there is adhesion?—Pass the hand into

the uterus, expand the hand, and gnaw off the placenta with the pulps of the fingers against the side of the uterus.

What may happen when the placenta, or part of it is retained? — Irritation, pain, and inflammation of the uterus, and putrefaction of the placenta, &c.

What is the treatment in these cases?—To wash out the cavity of the uterus by mild detergent washes, thrown into the uterus by proper syringes.

What is meant by clearing the woman? — The complete removal of the placenta, membranes, and other discharges from the vagina and vulva of the female.

When should the umbilical cord be cut? — Not until the respiration in the child is fully established, and we have free circulation of its blood, and the artery of the cord has ceased to pulsate.

How many ligatures would you apply to the cord?—Generally but one.

Where should the ligature be situated? — About two inches from the abdomen.

How should you give the child to the nurse, and how should she receive it? — You may take the child about the thorax between the thumb and fore-finger, and support the limbs with the other hand, and then give it to the nurse in a warm flannel blanket, and wrap it warmly.

What do you mean by asthenia in the new-born infant? — A state of debility, with shrivelled features, difficult respiration, enfeebled circulation, with groaning, &c.

What is necessary in such a state? — To stimulate the respiratory muscles gently by mild frictions, washing it in alcoholic fluids, gently inflating the lungs, wrapping it in flannel or cotton wadding, and handling it carefully.

What is meant by asphyxia?—A state of apparent death.

How many varieties are there?—Two; the simple, and congestive.

What are the causes of this state? — Pressure upon the child in the passage of the pelvis, or upon the cord or placenta; knots in the cord; membranes over the face of the child; suffocation from the fluids or from the bed-clothes; or from the larynx and trachea being filled with mucus.

What are the evidences of the two varieties of asphyxia?—Palor; want of respiration in the first variety; and in the second, the face is swollen and turgid with blood; absence of the respiration and circulation, and coldness of the surface, &c.

What is the treatment of asphyxia of the second variety?—Remove all mechanical impediment to respiration; let the cord remain uncut; keep the body warm by warm bathing; use gently-stimulating frictions; also stimulating injections. Now use the warm bath, and then dash cold water upon the thorax; imitate the process of respiration by the hand;

breathe into the lungs; and in cases of congestion, allow blood to flow from the cord, to the amount of half an ounce or an ounce.

Is the tracheal tube of much use? — No.

Must we not keep up this treatment for some time? — Yes, for an hour or more.

What is the character of the tumours sometimes upon the scalp of infants? — They are bloody and ecchymosed.

How are they formed? — From the blood being pressed into a portion of the scalp during delivery, and there being coagulated.

With what are these tumours often confounded? — With fracture.

What is necessary in cases of tumour of the scalp? — Very little need be done, though a lead-water poultice may be used, and if it should suppurate, open the tumour freely and poultice it.

What is necessary to remove the sebaceous matter from the body of the child after it is born? — Anoint the body with animal oil, or lard, and wash it with unirritating soap and water.

How would you dress the cord? — By cutting a small hole in a piece of linen, six inches square, passing the cord through it, and then doubling the linen around the cord so as to prevent the drying cord from irritating the integuments of the child, and then binding it with a flannel roller to the body of the child.

When does the cord usually dry up and fall off? — In five or seven days.

What should be the food of the child after it is born? — The mother's milk, or a little sugar and water.

MANAGEMENT OF THE WOMAN AFTER DELIVERY, ETC.

After the woman is delivered and placed in bed, what should be done? — A soft napkin should be placed loosely against the vulva, and the bandage properly adjusted.

What is the benefit of the bandage? — To prevent fainting from a sense of exhaustion, to promote contraction of the abdominal muscles, and to keep the uterus from again dilating with blood, &c.

What should be the diet of the woman after delivery? — Gruel and barley-water, and her drinks should be cool and simple.

When should the bowels be opened by a cathartic, if not open before? — On the third day after delivery.

What is the character of after-pains? — They are spasmodic and alternate, simulating labour-pains.

To what are they attributed? — To coagula within the cavity of the uterus, or upon an irritable condition of the uterus, bladder, and bowels, and from the uterus gradually contracting.

What is the treatment in these cases? — In the first instance we must force the uterus to contract firmly and expel the coagula; or, if they depend upon a peculiar nervous state, we must administer anodynes; and, should the bowels and bladder be affected, warm injec-

tions are highly beneficial; and drawing off the water from the bladder.

Is not venesection necessary? — Sometimes it is.

PELVIC PRESENTATIONS, ETC.

Why are pelvic presentations dangerous to the child? — From the fact that the head may be arrested in the pelvic cavity, after the body is born.

Why are they dangerous to the mother? — Because of the delay in the first and second stages of labour, and the great fatigue induced by the labour.

How would you diagnosticate pelvic presentations? — From the smaller size of the os uteri and bag of waters; from a sulcus between the limbs, or from the presence of the genital organs; from a fold in the groin; and sometimes from the presence of meconium upon the finger after making an examination per vaginam.

How do you divide pelvic presentations? — Into those of the breech, feet, and knees.

Which are the more unfavourable? — Those of the knees and feet.

What are the different positions of the pelvis? (Fig. 316.) — The same as those of the cephalic extremity, substituting the breech for the head.

Fig. 316.

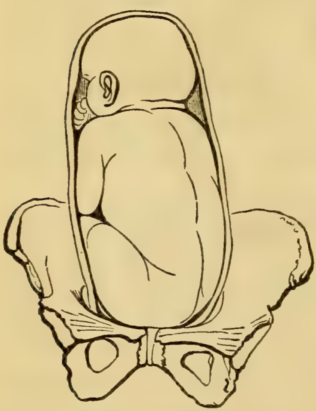


Fig. 317.

Is not the mechanism of labour similar in breech presentations to those of the head?—Yes.

What direction does the body take upon the hips being delivered? (Fig. 317.) — It bends laterally to accommodate itself to the cavity of the pelvis.

When the shoulders rotate, does the head follow them? — No; but the neck is twisted the fourth or sixth of a circle.

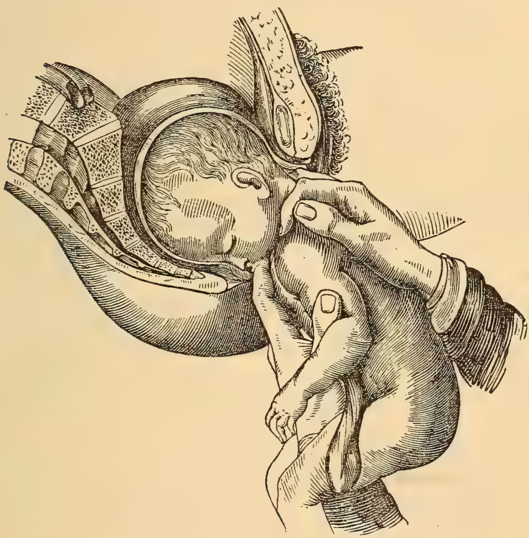
Does not restitution of the shoulders take place when they are delivered? — Yes.

How should the head present for ease and safety after the body is born? — Into the occipito-mental diameter, to the axis of the pelvis.

What is the danger if the physician draws upon the body of the child? — That the chin may leave the breast, and we may then have a long diameter of the child's head presenting to a short diameter of the pelvis.

How should the body of the child be carried to favour its proper engagement in the inferior strait? (Fig. 318.) — In the anterior varieties of pelvic presentations the body should be carried up towards the front of the body of the mother; and in the posterior varieties, the body of the child should be carried back.

Fig. 318.



Are there any differences in the mechanism of the presentations of the feet and breech? — None of importance.

Is there not greater danger to the child in feet than in breech presentations? — Yes; from compression of the body and thorax, &c.

Why are the shoulders less easily delivered in these cases than in breech presentations? — Because the os uteri will allow the feet and breech to pass through it when but partially dilated, while the shoulders require a greater degree of dilatation; and also when the body is pressed down, the arms mount up alongside of the head.

What are the points of the legs in knee presentations corresponding with the occiput and anterior fontanel in cephalic presentations? — The anterior part of the legs correspond with the nape of the neck, and the anterior parts of the thighs with the anterior fontanel.

What directions should be given to your patient in all cases of pelvic presentations? — That she must not bear down in the least during the first stage of labour; and if necessary, the practitioner should support the bag of waters, and administer anodyne enemata, and insist upon the recumbent position.

Should the practitioner be at all officious in making traction, or in favouring rotation, &c.?—No; let nature take its course.

What attention should be given to the cord? (Fig. 319.) — When the body is delivered as far as the umbilicus, we must draw down a loop of the cord to prevent traction upon it, and compression; and should there be much compression, endeavour to place the cord in a more unoccupied part in the pelvis.

Fig. 319.

When the body of the child emerges, how should it be supported? — Longitudinally upon the arm, and then carried so as to let the head curve upon the cavity of the pelvis and inferior strait.

Can you not, by introducing a finger in the mouth or along side of the nose, make the head more easily emerge from the cavity of the pelvis? (Fig. 318.) — Yes.

Can we not by proper manipulation so operate upon the breech in the third or sixth position, as to cause proper rotation of the shoulders? — Yes.

When must we make this rotation? — When it is in the cavity of the pelvis.

What may be done in addition in cases of the sixth position? — First convert it into the fourth or first position; and when the shoulders are delivered, change it into a first or second position.

What is an important rule in footling cases? — Keep back the feet until the first stage of labour is completed.

INSTRUMENTAL DELIVERY, ETC.

What are some of the cases where the accoucheur must resort to medical and surgical aid? — In rigidity of the os uteri or of the external organs, hemorrhage, convulsions, inertia of the uterus, mal-

positions of the fœtus, deformities of the pelvis, too great size of the head of the child, and the existence of tumours of the pelvis.

What are the classifications of obstetrical instruments? — Those which do not injure the mother or child; those which destroy the child for the safety of the mother's life; and those which risk the life of the mother to save that of the child.

In what cases should we use the hand alone?—Where the position is bad, to produce version; in hemorrhage, &c.

What is meant by version of the head?—The bringing of the head to the axis of the pelvis, when some other part of the child has been presenting.

What is meant by version by the feet? — When the hand is introduced into the cavity of the uterus, the feet of the child seized and brought down.

Which is to be preferred, version by the head or feet? — Version by the head whenever it is practicable.

What are the dangers of version?—Pain, hemorrhage, and rupture of the uterus to the mother, and too great twisting of the spine of the child.

Which is the more frequently resorted to in this country? — Version by the feet.

What must be the condition of the os uteri before attempting version? — It must be dilated, or easily dilatable.

When should you make version?—Before the head has passed the os uteri, and as soon as the first stage of labour is completed.

What should be the position of the patient for version? — Upon the back, with her hips over the edge of the bed and her feet supported.

How should the accoucheur stand? — In front of the patient, and at his ease.

What hand must be used in version by the head? — That which corresponds with the side to which the occiput presents.

In what way must you introduce your hand within the soft parts? — First lubricate the hand and soft parts, and then pass it within, during a pain, in a conical form — the thumb being bedded between the fingers.

When the hand is introduced, what should be its position?—Semi pronate.

After the hand is introduced, what then should be the position?—Supined.

When are you to make the rest of the manœuvre? — In the absence of a pain.

How would you seize the head to produce version by it? — First push up the head, slide your hand under it or along side of it; then embrace the head, then carry the chin to the iliac fossa opposite to the occiput, and let the occiput descend.

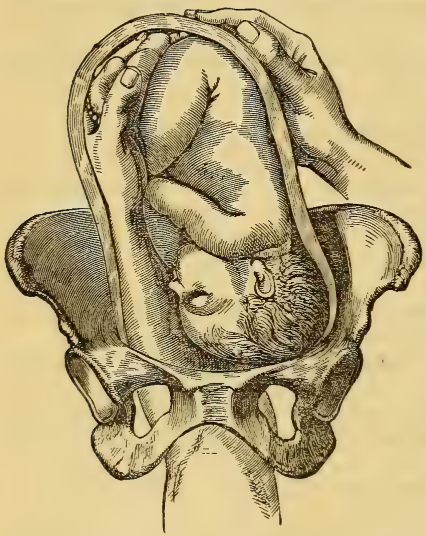
How would you support or regulate the fundus of the uterus? — With the other hand over the abdomen.

When would you resort to version by the head? — When the head is within the reach of the hand.

In version by the feet, which hand would you use?—That one the palm of which is towards the front of the body of the child.

How are you to proceed in version by the feet? (Fig. 320.) — Introduce your hand during the absence of a pain; disengage the head, pass your hand over the side of the child, following the course of the limbs; embrace the feet, and keep the heels in the hollow of the hand until they are brought into the iliac fossa or cavity of the pelvis; insinuate the index finger between the feet, and withdraw the feet outside of the vulva.

Fig. 320.



When you can find but one foot, what must be done?—Draw it carefully in the axis of the pelvis, and as much as possible towards the side where the other foot should be.

How would you secure the one foot while you search for the other? — By passing a fillet around the ankle, and letting the fillet hang outside of the vulva.

Is it always necessary to find the second foot? — No.

Where should you always attempt to bring the back of the child's foot? — At the anterior part of the pelvis.

What position of the feet should you favour when you use the right hand for turning? — The first.

What when you use the left hand? — The second.

Is it not necessary, after turning, to favour rotation of the hips, shoulders, and head? — Yes.

If the arms should have a tendency to mount up alongside of the head, how would you manage? — Resist the descent of the body of the child, and let the uterus force down the arms; or else pass up your finger and bring down the arms, favouring flexion of the arms at the elbows.

When the shoulders are delivered and the head does not advance

readily, how would you favour it ?—Push back the body of the child, pass up two fingers, and press them upon the malar bones or upon the chin, and bring the chin down to the breast.

When the head is arrested in the inferior strait, what instrument should you make use of? — The forceps.

Is it not wise to have your forceps at command in cases of pelvic presentations? — Yes.

In what cases is it sometimes necessary to bring down the feet? — In cases of inertia of the uterus

How would you manœuvre to bring down the feet?—Push up the breech, and then hunt after the feet.

Which hand would you use? — That in which the palm looks to the abdomen of the child.

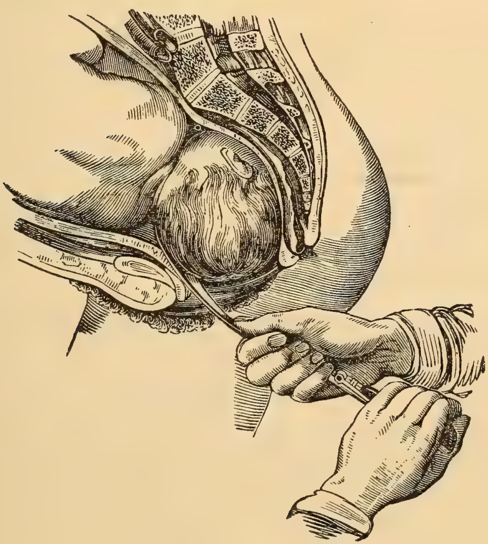
If the breech becomes arrested in the cavity of the pelvis, how would you manipulate? — Attempt to bring down the breech by passing up the hand, and fix the thumb in one groin and a finger in the other; or pass up a fillet around the hip; or else make use of the simple blunt hook, or Ludlow's guarded blunt hook.

In using the blunt hook, should you injure the mother? — No.

Into which groin should you pass the blunt hook?—In the sacral, if possible; but we most frequently pass it into the pubal.

How would you guide the blunt hook to its proper position? — By the points of the fingers.

Fig. 321.



In what other cases is the blunt hook applicable?—To bring down the arms of the child, or to hook upon the lower part of the orbit of the eye, or in the mouth, to produce flexion of the head.

By what instrument can you correct deviated positions of the head? (Fig. 321, p. 667.)—By the vectis or lever, a curved instrument, adapted to fit the different parts of the child's head.

In what capacity is the vectis used?—As a lever and tractor.

In what positions of the head is it especially useful?—In transverse positions.

Is not the forceps a very efficient and valuable instrument?—Yes.

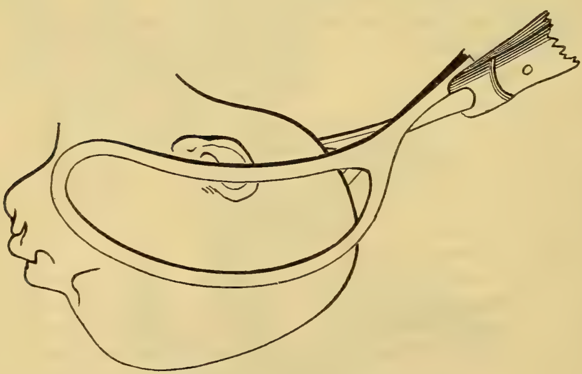
How are the forceps made?—From steel; with two blades to fit the child's head, and so constructed as to be introduced separately, and then locked.

What mode of locking is considered the best?—The German, or where we have a conical screw-pivot and conical notch.

What are the two varieties of the forceps?—The short, or English, and the long, or French.

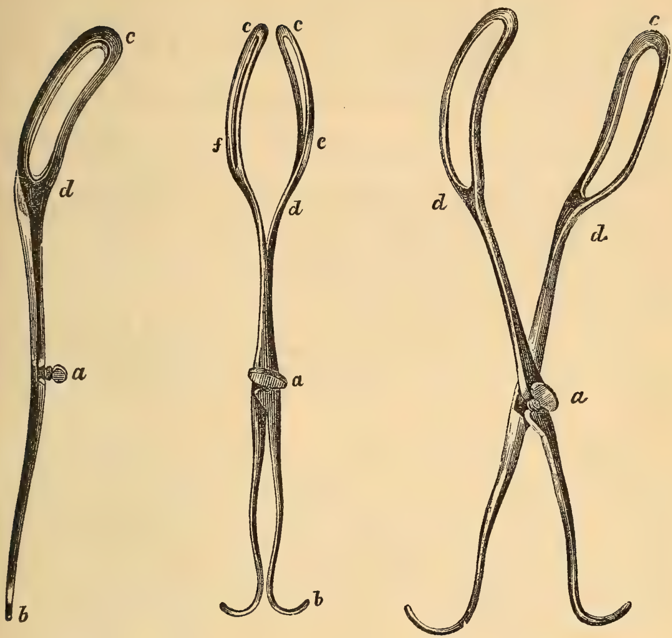
Which forceps are generally preferred in this country?—The long. Dr. Meigs prefers Davis's short forceps. (Fig. 322).

Fig. 322.



The long forceps, which possesses many advantages over every other form of forceps, in my opinion, is that of Professor Hodge, of the University of Pennsylvania, and which he has modestly called, "the eclectic forceps." After many years experience in its use, and many trials of its capacity in different parts of the pelvis, I cannot but give it my unqualified recommendation. The annexed wood-cut gives a good representation of it (Fig. 323). It is exceedingly light, weighing 1 pound 1 oz.; 16 inches in length, from *b* to *c;* from the joint *a* to *b*, 6·8; from *a* to *d*, parallel shanks, 3·5; from *d* to *c*, the blades, 6 in.; from *c c*, extremities, to *e f*, the greatest breadth, 3·7. The

Fig. 323.



separation of the points, *c c*, when the handles are in contact, is 0·5 of an inch; from *e* to *f*, the greatest breadth, when the handles touch, is 2·5; when the separation at *e f* is 3·5, the points *c c* are separated 2 in.; the breadth of the blade is 1·8, tapering to 1·7 near *c c*; the breadth of the fenestra is 1·1; the thickness of the blade is 0·2 of an inch. The perpendicular elevation of the points *c c*, when the instrument is on a horizontal surface, is 3·4, or the curvature of the blade; the elevation of the handles near the joint above the horizontal line, is 1·3, including the thickness of the blades, which indicates the extent of the angular bend in the handles.

Where may you act with the long forceps? — In any part of the pelvis.

To what part of the child would you use the forceps? — Always to the head.

To what part of the head would you apply them? — To the sides, except in transverse positions, when rotation cannot be effected.

In what diameter of the head should the forceps be applied parallel? — To the occipito-mental.

Should the mother be subjected to any pain in the use of the forceps themselves? — No.

Is the child's head liable to injury from the forceps? — Not as a general rule, but it may be to a slight degree in very difficult cases.

When are forceps indicated ?—When we have great resistance from the soft parts; when the system of the mother is much enfeebled; when we have convulsions, &c.

Should not the first stage of labour be complete before you attempt to use the forceps? — Yes.

Must you not be sure in your diagnosis before you attempt to use the forceps? — Yes.

How would you place your patient for the use of the forceps?—On her back, and her breech drawn to the edge of the bed, with her limbs separated, and feet well supported.

Should not the bowels and bladder of the woman be well evacuated before using the forceps? — Yes.

What are the peculiarities of the two blades of the forceps?—The one has the pivot in it, and is called the male or left-hand blade; and the other has the notch, and is called the female or right-hand blade.

Which blade should be introduced first? — The left-hand or male blade.

What are the steps in the use of the forceps? — First apprise the patient and her friends of your intention; then place your patient in the proper position, warm the instrument, and lubricate it and the vulva and the right hand of the accoucheur. The accoucheur then takes the left-hand or male blade in his left hand like a writing pen, stands between the limbs of the patient, and guards the blade with the fingers of his right hand. The handle of the forceps should be carried nearly perpendicular to the body of the patient; its point is to be glided along the palm of the hand and the fingers, gradually becoming parallel with the patient's body, until the blade is placed by the side of the child's head in the occipito-mental diameter. The handle is now to be supported by the hand of an assistant; the other blade is now to be introduced and fixed as the former blade, and the two locked.

Should not the points of the instrument always be kept against the sides of the child's head? — Yes; we then avoid injuring the soft parts of the mother.

Must the blades lock readily? — Yes.

Is there not danger sometimes of passing the forceps outside of the os uteri? — Yes.

Should you make slight compression and traction when the blades are fixed? — Yes, to prevent the lips of the os uteri being pinched.

When may you apply a fillet to the handles of the forceps? — To compress the head when the pelvis is too small, or the head of the child too large.

In what capacity are the forceps used? — As levers and tractors.

Must we not support the perineum of the female when delivering by the forceps? — Yes.

How should you move the handles of the blades of the forceps?—From side to side of the head, and always from handle to handle.

How would you apply the male blade when the head is oblique in the cavity of the pelvis?—At first, elevate the handle, pass in the blade, sweep it under the top of the head, depress the handle rapidly to bring the blade to the side of the head, and that the pivot may look to one groin of the mother.

How would you act with the female blade?—Pass it into the cavity of the pelvis, under the top of the child's head; then, by using the fingers, depress the handle of the blades to sweep it over the parietal protuberance, and then let the blade lock with the pivot to the left groin of the mother, if the case is one of the first position.

If the shoulders are arrested, how would you act?—By making traction upon the head, or by passing up the blunt-hook, and then making proper traction.

If the head is arrested in the superior strait, would you turn or use forceps?—If acquainted with the use of the forceps, use them; if not, turn.

Is there not much difficuly in applying the forceps at the superior strait?—Yes.

How would you protect the mother from injury in using the forceps in the superior strait?—By passing up the hand to the head of the child sufficiently high as a guide and guard.

What is the difficulty in applying the forceps in the second position of the vertex?—The male blade occupies so much space at the anterior commissure of the vulva, that the female blade is introduced with difficulty.

How can you overcome this?—First introduce the male blade to its proper situation, then retract it a little till it is opposite the left ischium; let an assistant support it; now introduce the female blade; now pass up the male blade to its original position; and if you have done all properly, the blades will lock.

Must we ever introduce the blade in front of the perineum, and the other under the arch of the pubis?—No.

In cases of pelvic presentation and retained head, how are you to manage the body of the child?—Where the occiput is anterior, the body is to be carried over the abdomen of the mother; while in posterior positions of the occiput, the body is to be carried to the sacrum of the mother.

Is it not difficult to deliver the head from the superior strait when the body is delivered?—Yes.

How would you manage in such a case?—First get the head in a proper position, and then apply the forceps, or make use of instruments adapted to it; and sometimes take out the brain.

What is the smallest diameter through which a living child can pass?—Three inches.

What must be done in cases less than three inches?—Resort to the perforator, the crotchet, or gastro-hysterotomy.

When the brain is broken up, what is the condition of the bones of the cranium? — They easily collapse.

What are the diameters of the base of the skull when the vault of the cranium is removed? — The face is from one to one and a half inches; two inches with the lower jaw; transverse diameter, two inches and a half.

What is meant by craniotomy and cephalotomy?—Breaking up the bones of the child's head.

What instruments are used for this?—A perforator, and Smellie's scissors, or Ludlow's improved cranial perforator, or Holmes's.

Must not the uterus be supported in this operation?—Yes, firmly, by the hand externally.

When you operate, how are you to proceed?—The scissors or perforator is to be well guarded, by the points of the fingers, to the head, and the point of the instrument fixed in a fontanelle or suture; push the scissors to the guard of the blades, then open the handles and cut from within out, and then turn it again and proceed as before; then pass the scissors inside of the skull and cut up the brain; and then, if necessary, apply the forceps and compress the skull.

Fig. 324.

Fig. 325.

When you use the crotchet, how would you apply it?—It is to be passed inside of the cranium, and fixed upon some point within the cranium, and traction made.

What are some of the other instruments for diminishing the child's head? (Figs. 324, 325.)—The craniotomist; the bone forceps of Dr. Meigs; the osteotomist, of Dr. Davis, &c.

Is ergot or turning ever to be resorted to in cases of deformity? — No.

How large must the opening be to bring down the base

of the cranium? — From one end and a quarter to one and a half inches antero-posteriorly, and from two and a half to three transversely.

Is cephalotomy dangerous to the mother? — No; not if done in time and with care.

If the body will not pass, what must be done? — It must be broken up.

When is it right to recommend the Cæsarean section?—When the child is alive and the mother is in a good state.

What are the objections to the Cæsarean section?—It involves the life of the mother, and does not always preserve the life of the child.

Is the crushing forceps of Baudelocque, or its modification by Dr. Hodge, ever used to diminish the size of the child's head? — Yes.

In what cases is artificial premature delivery resorted to? — In those cases where, if pregnancy was allowed to proceed to its full term, the child could not be delivered without the operation of embryulcia, or opening the head, &c.

At what month would you induce artificial delivery? — At the eighth, or a little earlier.

How would you induce artificial delivery? — By stimulating the uterus to contraction, or by puncturing the membranes.

When the antero-posterior diameter is two and three-quarter inches, what must we resort to?—Either premature artificial delivery, delivery by the crotchet, or by the Cæsarean section.

In cases of sixth position, when the head will not rotate by any means in your power, what instrument must be used? — The forceps, carried high up, or a fillet, with a piece of whalebone, carried over the occiput, to draw the occiput down.

Does the anterior fontanelle ever present in practice? — Yes; from flexion not being perfect.

If the occiput should be arrested at the linea ilio-pectinea, what is the consequence? — A locked head and impracticable labour.

How would you avoid this difficulty? — Resist the descent of the forehead by pressing against it with the finger, or else hook down the occiput with a lever, in the absence of a pain.

Can you ever effect flexion and rotation at the same time, in cases where the head is in the cavity of the pelvis, or in the inferior strait? — Yes, by passing the lever under the sacral side of the occiput, or pass one or two fingers in the anus, and press against the head through the rectum and vagina.

In cases of undeviated third position, what is necessary to be done? —Push up and rotate the head, increase flexion, and let the occiput descend.

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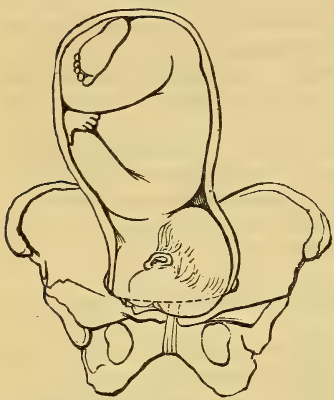
FACE PRESENTATIONS, ETC.

In face presentations, what parts present to the straits of the pelvis? (Fig. 326.) — The fronto-mental and bi-temporal to the plane of the straits, and the root of the nose to the centre of the pelvis.

Fig. 326.



What is the principal difficulty in face presentations? — The occipito-bregmatic diameter is added to the antero-posterior diameter of the thorax when the head descends in the pelvis.

In what face presentations does this occur? — When the forehead is anterior, and the occiput is thrown back upon the spine of the child.

Can the child be born alive in such cases? — No.

When the chin presents to the anterior part of the pelvis, can the child be born alive? — Yes.

What diameters present to the pelvis in face presentations? — The fronto-mental and bi-malar, or the trachelo-bregmatic and bi-parietal.

When the chin presents to the sacrum of the mother, can the face enter the superior strait? — Yes.

What are the varieties of face presentations? — The same as the occipital

Which are the most frequent face presentations? — The right mento-iliac and left mento-iliac.

Is not labour comparatively easy if the chin comes under the arch of the pubis? — Yes.

Describe the mechanism in these cases. (Fig. 327, 328.) — First, great extension takes place, then rotation of the chin upon the anterior plane to the arch of the pubis, and then flexion until the head clears the perineum.

When you find the child descending, face foremost, in the superior strait, what must be done? — Either make version by the head or feet.

How many positions of the anterior fontanelle are recognised? — Six; the same as of the occiput.

Can you not sometimes alter these before the membranes are ruptured? — Yes.

What change would you attempt to make in them? — To an occipital position, by producing flexion and rotation.

Is not the lever useful in these cases? — Yes; for by it you may favour rotation and flexion.

Fig. 327.

Fig. 328.

When the top of the head is coming under the arch of the pubis, and you cannot rotate it, what is necessary ? — Apply the forceps.

How would you apply them ? — By depressing the handles, and applying the ends of the blades high above the pubis.

If you cannot use the forceps, what instruments are indicated ? — The perforator and crotchet; and then, if possible, the forceps.

What deviations may be converted into face presentations ? — Where the forehead presents and cannot be rectified to an occipital presentation.

When the occiput is anterior, what is the danger of this ? — Producing an impracticable labour.

Should you ever allow the forehead presentations to remain ? — No.

What must be done in these cases ? — Convert the fronto-anterior position into the chin presentation, and bring down the occiput, when the position is with the forehead anterior.

When the chin is anterior in positions of the face, how would you apply the forceps ? — Apply the blades of the forceps as in occipito-anterior positions; and when the chin clears the anterior commissure of the vulva, draw a little forward with the front of the thorax against the under part of the arch; then carry the handles rapidly over towards the abdomen of the mother.

Do we frequently meet with positions of the side of the child's head ? — No.

When these positions do occur, how can you recognise them ?—By the presence of the ear, a mastoid or a zygomatic process, &c.

How do you correct these positions ? — By pushing up the head and bringing it down in an occipital position.

Do other parts of the body ever present ? — Sometimes.

In deviated positions of the body of the child, should you wait for spontaneous version ? — No.

How many presentations of the shoulders are there? (Fig. 329.)—Two; one of the right and the other of the left.

Fig. 329.

How do you diagnosticate shoulder presentations?—By the presence of a tumour on one side of the neck, and of the clavicle, the scapula, and the arm and hand, &c.

What are the positions of the shoulders?—Dorso-pubic and dorso-sacral of the right and left shoulders.

What is meant by spontaneous version?—That movement by which the body of the child is turned to a favourable from an unfavourable position of its own accord, or by the action of the uterus.

Does this often occur in shoulder presentations?—No.

In shoulder presentations should you wait for spontaneous version?—No.

When the lower parts of the body presents, what must be done?—Pass in the hand and bring down the breech or feet.

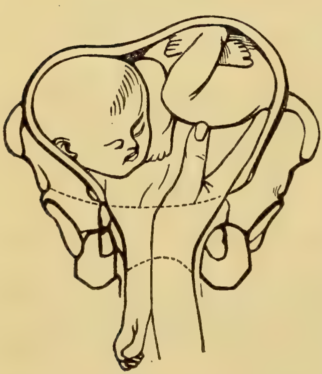
When the upper part of the body present, what must be done?—Pass in the hand and make version by the feet.

Must the soft parts be well relaxed and dilated?—Yes.

Should the membranes be preserved till the parts are well dilated?—Yes.

Which hand must be used?—The same as in cases of version by the knees or feet.

Fig. 330.



In cases where the dorsum of the child is to the pubis of the mother, which hand is to be introduced?—The one which can be readily applied to the iliac fossa in which the breech is situated.

When the dorsum of the child is towards the sacrum, what is the rule of action? (Fig. 330.)—In dorso-sacral positions of the right shoulder, and the breech in the left iliac fossa, the right hand must be passed up in front of the child in a prone condition, &c.

Must we attempt to produce version when the uterus contracts?—No.

When the body has been under great pressure in the cavity of the

uterus in the pelvis, must you act immediately or allay the contractions?—You must allay the contractions.

If the child is dead, must you resort to version?—No; you must deliver by the crotchet, &c.

COMPLICATIONS OF LABOUR, &C.

When an arm or hand descends with the head, what must be done?—Support the hand at the superior strait while the head descends.

Must you ever make traction by the hand?—No.

Is not the descent of the umbilical cord a complication of labour?—Yes.

How does it complicate labour?—By its being pressed upon, and impeding the circulation of the child.

When the cord has prolapsed, what must be done?—Carry it above the superior strait and support it there, and allow the head to descend.

In cases of intra-uterine hydrocephalus, what must be done to the child's head?—Open it, and allow the water to escape, and then complete the delivery by the forceps or blunt hook.

How would you bring down the base of the cranium if it has been found necessary to destroy the vault?—With the facial extremity foremost.

In twin pregnancy are the signs very marked?—No.

What sign can most be relied upon?—That by auscultation, when two hearts can be heard pulsating.

In the third stage of twin pregnancy do we experience any greater danger than in simple cases?—Yes, from the over-distension of the uterus and its liability to an atonic state, and the danger of hemorrhage.

In cases of twins, if the head of one child and the feet of the other engages simultaneously, what must be done?—Push up the feet of the one, and let the head of the other descend, or else deliver by the forceps; or resort to craniotomy, &c.

Suppose that the head of one child locks with the head of the other, what is necessary?—To detruncate the child which has descended first, and then push up the head, and then deliver the second child, and then the head of the first.

How many obliquities of the uterus are there?—Three—one anterior and two lateral.

Do not these obliquities usually correct themselves?—Yes.

If they do not, how would you act?—Favour the change of them by the proper position of the female. In lateral obliquities, by placing her upon the side opposite to the one where the fundus of the uterus lies; or an anterior obliquity, by placing a bandage around the

abdomen of the female, and compressing the fundus of the uterus against the spine, and, if necessary, hooking the mouth of the womb with the finger down to its proper position, and holding it there.

In cases where the os uteri cannot be reached by the finger, should we ever resort to harsh measures? — No.

What is meant by the retroversion of the uterus? — When the fundus is thrown in the hollow of the sacrum, and the os tincæ carried behind the pubis, or the neck of the uterus bent upon itself.

When does retroversion usually occur? — During the first three months of pregnancy.

What are the effects of retroversion? — Retention of urine and fæces, more or less paralysis of the lower extremities, &c.

What are the causes of retroversion? — Violent straining or jars, the weight of impacted fæces in the colon, &c.

What are the symptoms of retroversion? — Great bearing down, difficulty in evacuating the bowels or bladder, and difficulty in walking, &c.

What is the best sign of retroversion? — That elicited by the touch.

What are the indications of treatment? — Restoration of the organ, if possible; but if the uterus is too far developed, we must palliate the symptoms and produce abortion.

What is meant by antiversion of the uterus? — When the fundus of the uterus is thrown too far forward upon the parietes of the abdomen and the os tincæ high up in the hollow of the sacrum.

What other causes have we to interfere with the function of parturition? — Too great rigidity of the os uteri and soft parts; too great plethora; high nervous excitement, &c.

How would you counteract these? — By the usual remedies: by bleeding, anodynes, warm injections, &c.

Do not irregular contractions retard labour? — Yes.

When there are spasmodic contractions of the internal os uteri, how would you obviate them? — By venesection, anodyne injections, &c.

What is meant by rupture of the uterus? — A lesion of the substance of the uterus.

What are the symptoms of rupture of the uterus? — Sudden suspension of the alternate contractions, great prostration of strength, rapid pulse, and evident sinking.

What are the consequences of this accident? — In a few instances patients may recover, but in a large number death ensues.

In case of rupture of the uterus, what must be done? — If the rupture takes place in the first stage of labour, gastrotomy should be immediately resorted to, but if in the second stage, version by the feet or delivery by the forceps.

When the child has escaped through the rent in the uterus into the cavity of the abdomen, what is the proper practice?—Place one hand upon the parietes of the abdomen over the situation of the child; pass the other within the pelvis, up through the rent of the uterus, into the abdominal cavity, and deliver by the feet.

In what cases of ruptured uterus would you use the forceps or crotchet? — When the head of the child is within the cavity of the pelvis, and the body high up.

What are meant by puerperal convulsions? — Those which supervene upon a puerperal or pregnant state.

What are the varieties of these convulsions? — Hysterical and apoplectic.

Upon what do hysterical convulsions depend? — Upon irritability of the nervous system.

What are the effects of these convulsions upon labour? — They suspend or retard it.

What are the symptoms of apoplectic convulsions? — Intense pain in the head, sometimes in a particular spot; loss of vision; pulse full, slow, and laboured, frothing at the mouth, spasm of the muscles, &c.

What effect has convulsions upon gestation? — They may cause the death of the fœtus, or produce abortion.

Are the labour-pains generally suspended during convulsions? — Yes.

To which should you direct your attention in this state of things, the uterus or the convulsions? — The convulsions.

What is the treatment for the apoplectic variety?—Bleeding, generally and locally, cold to the head, purgatives, followed by revulsives and counter-irritants.

Should we, in cases of convulsions, interfere with the process of gestation if it is not complete?—We may bring on premature labour if the convulsions resist all treatment.

What is meant by inertia of the uterus? — A want of action, either tonic or expulsive.

What are its causes? — It may depend upon uterine plethora, or from actual debility.

What is meant by concealed hemorrhage?—When the blood which is effused from the patulous orifices of the bloodvessels of the uterus, on its inner surface, is prevented from escaping externally, and it then gradually fills the cavity of the uterus; and in some instances death is caused by the immense amount of blood so lost.

What are the varieties of inversion of the uterus?—Complete and incomplete.

What must be done in inversion of the uterus?—At first endeavour to replace the organ, or else draw the inverted fundus down, and make the inversion more complete.

Which kind of inversion is the more dangerous?—The incomplete, from the danger of strangulation.

By what means can we stimulate the uterus to contraction?—At first by frictions, enemata, warm teas, &c.; secondly, if the os uteri is dilated, rupture the membranes, pull gently upon the os uteri, or finally administer ergot.

In what cases is ergot alone applicable?—When the os uteri is well dilated, the soft parts relaxed, the pelvis capacious, and the position of the child favourable.

In cases of hemorrhage in the third stage of labour, what is the necessary treatment?—Excite the uterus to contract by frictions, by kneading the abdomen, by cold applications externally, by compression, by irritating the lining membrane of the uterus, and by the administration of ergot.

If the patient has been subject to atony or hemorrhage, when may you give ergot?—Just as the child is about passing out.

How soon should you leave your patient after delivery?—Not until reaction has taken place.

In cases of syncope during pregnancy, should we be alarmed?—Not generally.

What is meant by abortion, and when does it take place?—The discharge of the ovum from the mother, or its detachment from the uterus, though not discharged before the end of the sixth month.

When is the expulsion of the ovum called premature delivery?—From the end of the sixth to the ninth month.

What are the causes of abortion?—Among them may be mentioned, extremes of health, great constitutional irritation, plethora of the uterus, irritability of it, &c.

How may abortion more certainly be produced?—By rupturing the membranes.

What are the symptoms of abortion?—Great weight and pain in the pubic and sacral regions; a muco-sanguineous secretion escaping from the vulva, &c.

Is it easy to diagnosticate between abortion and dysmenorrhœa in the first three months of supposed pregnancy?—No.

What are the usual diagnostic signs of abortion?—Regular intermitting pain in the back, slight hemorrhage and watery discharge, with strong bearing down expulsive pains.

What are the consequences of abortion?—Some women recover entirely, but others suffer much.

How can you prevent abortion?—Diminish morbid irritability, either by bleeding or by giving tonics; by the use of revulsives, and styptics, &c.

What mechanical means have we for arresting hemorrhage at this time?—The tampon, made of muslin, or a sponge.

What must first be done before using the tampon?—First reduce the force of the circulation, and then allay pain by opiates.

When the ovum is detached from the uterine surface, what is the proper treatment?—Encourage its expulsion.

If it is not easily expelled, what instruments have we to assist it? —Dewees's hook, and Hodge's and Bond's abortion forceps.

Upon what does uterine hemorrhage depend during labour?—Upon detachment of the whole or some portion of the placenta.

Is not hemorrhage sometimes unavoidable?—Yes; when the placenta is detached from the uterus by the uterus being developed rapidly; and the placenta is situated over the os uteri, as in *placenta prævia*.

How can you ascertain this?—By examination per vaginam.

How can you arrest hemorrhage in these cases?—By placing the patient in a recumbent position, with the hips elevated, circulation reduced, and by the administration of styptics, the application of ice, &c.

How are you to deliver in such cases when necessary?—When the uterus is dilated or dilatable, pass the hand between the chorion and the uterus; perforate the membranes high up, grasp the feet, and turn and deliver; always have your forceps at hand to deliver the head if any delay of the head should occur. Drs. Simpson and Radford have recommended the entire detachment of the placenta, so as to allow the uterine contractions to close up the uterine vessels. The first plan has the weight of experience as being the better, on its side, and is most frequently resorted to. Another plan suggested, is to plug the vagina, allow the os uteri to dilate naturally, and the expulsive pains to force out the placenta, membranes, and fœtus, together with the plug, when the whole may be removed from the cavity of the vagina. Care must then be taken to make the uterus contract firmly.

What means would you make use of to favour dilatation of the os uteri, prevent hemorrhage, &c.?—The tampon.

When we have hemorrhage at the full term of pregnancy, what is the proper treatment?—Palliate during the first stage of labour, and deliver as rapidly as possible in the second stage.

If the contraction of the uterus is slow, how would you facilitate it?—By ergot, frictions, &c.

What anæsthetic agents have been resorted to in midwifery?—Chloroform and ether (letheon). The former of these, is not much used *by itself* in this country. In combination with ether some practitioners employ it. Ether by itself is, however, the article more frequently used.

How would you administer it?—In regard to the mode, &c., we would refer you to the closing pages on *Surgery, supra*.

Should you, under any circumstances, *promise* the administration

of an anæsthetic to a patient, previous to her confinement?—No; this should be left entirely to the judgment of the practitioner at the time of labour.

Do not the European practitioners make more free use of anæsthetics in midwifery, than those of our own country?—Yes; particularly Dr. Simpson. He has written several papers to prove its great value, to which we would refer the student. Dr. Meigs, of the Jefferson College, has ably discussed this subject by letter with Dr. Simpson; and by referring to Dr. Simpson's and Dr. Meigs's works, the whole subject may be understood.

PART VII.

MATERIA MEDICA,

PHARMACY AND THERAPEUTICS

WHAT is materia medica?—That science which treats of medicines, and manner of administration.

What is pharmacy?—The art of preparing and combining medicines for use.

What is therapeutics?—The application of medicine to the cure of disease, and also the peculiar modus operandi of medicines upon the system.

What are medicines?—Articles used in the cure of diseases, and which, as an ordinary result, produce modifications of the vital powers.

What influences may modify the action of medicines?—Age, sex, disease, climate, mode of life, habit, temperament, idiosyncrasies, and mental operations.

In what forms are medicines used?—In powders, pills, troches, electuaries and confections. In mixtures and solutions, in liniments, cerates, ointments, plasters, cataplasms, and vapours.

To what parts are medicines applied?—To the stomach, to the rectum by suppositoreis and clysters. By the skin; to the bronchial tubes and pulmonary air-cells, by inhalation of vapours; to the nostrils and adjoining cavities, by insufflation; and to the buccal mucous membrane.

Which classification of medicines is generally considered the best?—That founded upon the relation they bear to the system in an healthy state.

ASTRINGENTS.

What are astringents?—Medicines which produce contraction of the living fibre.

How are astringents divided?—Into vegetable and mineral.

In what cases are astringents applicable? — To arrest unhealthy discharges depending upon weakness of the bloodvessels, or when the discharge is kept up by habit when the exciting causes are removed, or when the discharges are very profuse.

VEGETABLE ASTRINGENTS.

What is the peculiar astringent principal in vegetable astringents? — Tannin.

QUERCUS. — What are the officinal names for the varieties of quercus? — Quercus alba, or white oak; and quercus tinctoria, or black oak.

What part of these is used? — The bark.

What are the sensible properties of the oak bark? — It has a feeble odour, and rough, astringent, bitterish taste.

What extracts its virtues? — Water and alcohol.

In what form is it used? — In powder, decoction, and extract.

What is the dose of these? — In powder from xx. to xxx. grs.; decoction, f℥ij.; extract, grs. xij.

What are its medicinal properties and uses? — It is astringent and tonic, and is sometimes used internally in intermittent fever, chronic diarrhœa, and passive hemorrhage, and externally in decoction, as baths in scrofula, in marasmus, diarrhœa, cholera infantum by injection; as a wash in hemorrhoides, in poultices, to unhealthy bleeding ulcers, &c.

Are not the leaves and acorn cups possessed of astringent properties? — Yes.

GALLS (*Galla*). — What are these? (Fig. 331.) — Excrescences upon the young branches of the quercus infectoria and other varieties.

Where is the tree found which produces them? — In Asia Minor and the countries adjoining.

What are the varieties of galls, and which are the best? — The blue and the white. The blue are the best.

What are their sensible properties? — They are astringent, bitter, and inodorous.

What extracts their virtues? — Boiling water and alcohol.

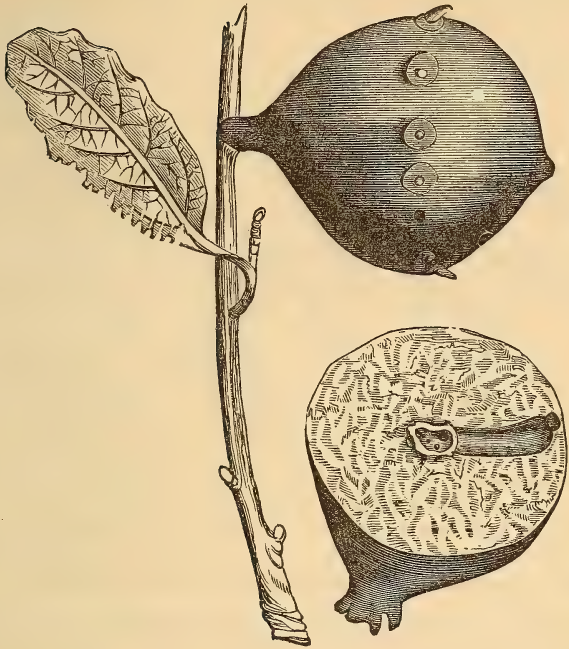
With what substances are they incompatible? — With the sulphuric and muriatic acids, gelatin, preparations of iron, &c.

How are they used, and what are the doses? — In powder, gr. x.–xx.; infusion made ℥ss. to Oj., and the dose f℥ij. They are also used in ointments, &c.

In what cases are they used? — As a gargle in sore throat, as a wash and ointment in hemorrhoides, flabby ulcers, &c., and in decoction as an antidote in poisoning from tartar emetic.

KINO. — What are the varieties of kino? — The African, Jamaica, Botany Bay, and the East India or Amboyna kino.

Fig. 331.



Which is the variety most used, and what is it?— The East India; it is an extract.

What are its characteristics? — It is in small, irregular, angulated, and shining fragments, of a dark-brown colour, and easily pulverized; and it has a bitter, astringent, and sweetish taste.

To what does it yield its virtues? — To water and alcohol.

What are its incompatibles? — Those of galls.

What are its properties and uses? — It is an astringent tonic, and is much used internally in cases of diarrhœa, either alone or in combination with opium, (also in infusion as an injection in leucorrhœa, in passive hemorrhage, particularly that of the uterus).

How is it used, and what are the doses? — In powder, from grs. x. to xxx.; infusion made with ʒij. to f℥vj. of water; dose fʒss. to fʒiss.

What is objectionable in the tincture? — It becomes thick when long kept.

Catechu. — From what is this derived? (Fig. 332.) — From the Acacia catechu as an extract.

Whence does it come? — From Hindoostan.

What is its appearance and qualities? — It is of different shapes; the colour, externally, is brown—internally, lighter; it is inodorous, and of an astringent bitter taste, and very brittle; the powder is dark-brown.

Fig. 332.

To what does it give its virtues? — To water and alcohol.

What are its impurities? — Sand and sticks.

What are its incompatibles? — The same as the preceding.

What are its properties and uses? — It is tonic and astringent, and is used in the same cases as the preceding article, and also in powder for spongy gums.

How is it used? — In powder, infusion, and tincture; the latter is the only recognised officinal form.

What is the dose of the tincture? — From fʒss. to fʒiij.

Rhatany (*Krameria*). — What is the name of the officinal variety, and where does it grow? — Krameria triandra, and grows in Peru.

What part is officinal, and what are its peculiarities? — The root which is in pieces of various sizes, with a dark, brownish-red, fibrous, easily separable bark, and a ligneous portion less coloured.

What are its sensible properties, and to what does it impart them? — It is without smell, but has a bitter, astringent, and slightly sweetish taste, all of which it imparts to boiling water and to alcohol. The colour of the powder is reddish.

What are its medicinal properties and uses? — The same as those of kino and catechu, but is particularly beneficial as an injection (when made in infusion by displacement) in affections of mucous membranes.

How is it used, and what are the doses? — It is used in powder, grs. xx.–xxx.; decoction or infusion, made ℥j. to Oj. of boiling water; dose f℥ij.–fʒij.; tincture, fʒi.–fʒii.; extracts, grs. x.–xv.

Logwood (*Hæmatoxylon*). — What is the name of the tree from which this is derived, and what is the part used?—It is the wood of the tree Hœmatoxylon campechianum.

Where does it come from?—From Campeachy and the shores of Honduras Bay.

How is it kept in the shops?—In chips or powder, and extract.

What are its sensible properties, and to what does it impart them? —It has a slight peculiar odour, and an astringent, sweetish taste, which it imparts to water and alcohol.

What is its peculiar principle?—Hematin.

What are its medicinal properties and uses?—It is mildly astringent and tonic, and devoid of irritating properties, and is used in diarrhœa, chronic dysentery, &c.

How is it used, and what are the doses?—It is used in decoction and extract. The decoction is made by putting ℥j. to Oij. of water, and boiling to Oj.; the dose is f℥ij. The extract which is prepared by evaporating the decoction to dryness, is given in from grs. x.–xxx.

Cranesbill (*Geranium*).—What part is used?—The root of the geranium maculatum.

Where is this found?—In the forests of our own country.

What is the appearance of the root?—It is horizontal and fleshy, with short fibres, and sends up annually an herbaceous stem. The root when dried is in pieces from one to three inches in length, flattened and contorted, and of an amber-brown color.

What are its sensible properties, and to what does it impart them? —It is inodorous and astringent, and imparts its virtues to water and alcohol.

What are its medicinal properties and uses?—It is powerfully astringent, and is used in diarrhœa, hemorrhages, and as an application to flabby ulcers, leucorrhœa, and aphthous ulcers of the mouth.

How is it given, and what are the doses?—In powder, grs. xx.-xxx.; in decoction, made by boiling ℥i. in a Ojss. of water to Oj., the dose is f℥j.–f℥ij.

Blackberry Root (*Rubus villosus*); and Dewberry Root (*Rubus trivialis*).—What part of these plants are used?—The roots, and they are similar in their medicinal qualities.

What is the distinction between these plants?—The former is the high blackberry, the latter is the creeping.

In what part of the roots does the most medicinal quality lie?—In the bark.

What are their sensible qualities, and to what do they impart their virtues?—They are inodorous, bitterish, and strongly astringent, and impart their virtues to boiling water, and to diluted alcohol.

In what cases are they used?—They are astringent, and are used chiefly in affections of the bowels.

How are the roots used, and what is the dose of each?—In powder,

grs. xx.–xxx, and decoction, made by boiling ℥j. in Ojss. of water to Oj.; the dose, f℥j.–f℥ij.

Uva Ursi.—What is the common name for this plant?—Bearberry.

What part is officinal?—The leaves of the Arctostaphylos uva ursi.

What is the character of the plant?—It is a small, trailing evergreen shrub, native in this country and in Europe.

What are the characteristics of the dried leaves, and to what do they impart their virtues?—They are about an inch long, a bright green on the upper surface, and pale and vesicular below; and when powdered they have a light-brown colour, bitterish, strongly astringent and sweetish taste, and impart their virtues to water and alcohol.

What are the active principles?—Tannic acid and bitter extractive matter.

To what complaints are they adapted?—To renal affections; in gravel, chronic nephritis, ulceration of the kidneys, &c., also in leucorrhœa, gleet, &c.

In what form are the leaves used, and what are the doses?—In powder ℈j.–℥j., three or four times a day; and of the decoction, made ℥j. to Oj. of water; dose, f℥j.–f℥ij.

What are some of the other vegetable astringents which possess properties alike, and which are used in the same cases as those mentioned before?—The pipsissewa; the rosa gallica; the rosa centifolia; the diospiros virginiana; the tormentil, &c.

MINERAL ASTRINGENTS.

Alum (*Alumen*).—For the chemical relations, &c., see *Chemistry*.

What is its sensible properties?—It has a white colour, the taste is astringent, sour, and sweetish, and it is without odour.

In what cases is it used?—In the same cases as the vegetable astringents.

Is it ever used locally?—Yes.

How is alum curd formed, and for what is it used?—By briskly agitating a solution of alum with the white of egg, and is used in ophthalmia.

How is alum administered internally, and what is the dose?—In powder, grs. v.–xv. every three or four hours. In pill or solution.

What are its chemical incompatibles?—The alkalies and their carbonates, tartrate of potassa, acetate of lead, and it is said also the vegetable astringents.

What are its effects upon the system?—It is astringent, and to a certain degree refrigerant, and when taken in large quantities, it distresses the stomach, and when in still larger quantities, it purges and vomits; in small quantities it constipates.

What are its uses?—It is beneficial in the same cases that vegeta-

ble astringents are, as a local application, as a styptic in hemorrhages, also as a gargle; it has been used as an emetic in croup, and also as remedy for whooping cough.

How is alum-whey prepared?—By boiling alum ʒij. in Oj. of milk, and straining; the dose, f℥ij.

How is dried alum prepared, and for what is it used?—It is prepared by driving off the water of crystallization by heat, and is used as an escharotic.

Lead—(*Plumbum*).—For the chemical relations, see *Chemistry*.

Is metallic lead medicinal?—No.

What effects have the preparations of lead when taken in large doses?—Poisonous.

What preparation of lead is probably not poisonous?—The sulphate.

What are the antidotes for the poisonous action of lead?—The sulphate of soda or magnesia.

What are the preparations of lead used in medicine?—The semivitrified oxide, or litharge; the carbonate, acetate, and subacetate.

Litharge.—For chemical properties and relations, see *Chemistry*.

What is its appearance?—It is in small, vitrified, brilliant scales, sometimes red and sometimes yellow.

Has it any smell or taste?—No.

What are its impurities?—Iron, copper, silver, and silica.

For what is it chiefly used?—For the preparation of the lead plaster.

For what is the lead plaster used?—As an application to excoriated surfaces, and for the preparation of other plasters.

How is this prepared?—By taking litharge powdered, ℔v., Ol. oliv. cong. j., Aqua, Oij., and boil them over a fire, continually stirring them.

Plumbi Carbonas.—What is the ordinary name for this?—White lead. See *Chemistry*.

What are its sensible properties?—It is white, heavy, opaque, and insoluble.

Is not this one of the most poisonous salts of lead?—Yes.

Is it often used internally?—No.

For what is it used externally?—As an application to ulcers, and to inflamed and excoriated surfaces, and is generally applied by sprinkling the powder over the part, or in the form of cerate.

What are the antidotes for its poisonous effects?—Opium, and mild aperients, as magnesiæ sulphas, castor-oil, and diluent drinks, and alum.

Plumbi Acetas.—What is the ordinary name for this?—Sugar of lead.

How is it prepared, and what is it chemically?—By boiling the

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carbonate in dilute acetic acid; chemically it consists of one part of acetic acid, one of the protoxide, and three of water See *Chemistry*.

What is the appearance of the crystals, and what effect has exposure upon them? — They are white, needle-shaped, prismatic, and effloresce on exposure.

What are the sensible properties?—It has a sweet, astringent taste, but without smell.

In what is it soluble? — In water and alcohol.

What are its incompatibles? — The mineral acids and their soluble salts, the alkalies and their carbonates, vegetable astringents and mucilages, excepting gum.

In what diseases is it applicable? — In diarrhœa, dysentery, hemorrhage, &c., and externally as a styptic, and to subdue inflammation, and as an injection in gonorrhœa, gleet, &c.

How it is used? — Both externally and internally; externally in grs. j.–ij. to f℥i. of water, and to the sound skin, ʒij. to Oj. of water; internally, in combination with opium, gr. ss. to grs. iij., every two or three hours, in pill or solution.

Liquor Plumbi Subacetas. — What is the common name for this? — Goulard's extract of lead.

How is it prepared? — By boiling litharge either in vinegar or a solution of the acetate of lead.

What is its taste and colour? — It is of a yellowish colour when made with vinegar, but otherwise lighter coloured, and it has a sweet, astringent taste.

What effect has exposure upon it? — It decomposes it.

How much is it diluted for use?—In the proportion of from fʒij.–fʒiij. to the pint of water.

Ceratum Plumbi Subacetas. — What is the common name for this? — Goulard's cerate.

From what is this prepared? — From the solution of the subacetate, by combining with it white wax, olive oil, and camphor.

In what cases is it applicable? — In ulcers, and abraded surfaces, and especially for blisters indisposed to heal.

Are not the preparations of the other metals generally astringent? — Yes.

TONICS.

What are tonics? — Medicines which moderately and permanently exalt the energies of all parts of the system without necessarily producing any apparent increase in their natural action.

In what state of the system are tonics indicated?—When the vital action is depressed below the standard of health.

How do tonics act? — They increase the energy of the stomach and bowels, and produce an invigoration of the nervous system and circulatory apparatus.

How would you classify tonics?—Into tonics of animal origin, pure bitters, bitters peculiar in properties, aromatics, and mineral tonics.

TONICS OF ANIMAL ORIGIN.

Which is the most important of these?—Cod liver oil (*Oleum Morrhuæ*).

Whence is this obtained?—From the livers of the common codfish, or gadus morrhua. The livers are either exposed to the sun, and the oil skimmed off, or they are boiled and the floating oil taken, or they are expressed. When pure, it is of a golden-yellow colour, and, when less so, of a brownish or wine colour, and as it is darker so is its purity deteriorated. It is composed of a peculiar principle, called *gaduin*, without efficacy, and biliary principles, a little iodine, olein, and margarin.

What are its effects upon the system?—An excellent tonic, producing an increase of fat and general strength to the whole system. Its action upon the debilitated anemic system is peculiar to itself, no other known agent producing so desirable results and so speedily.

In what cases is it used?—In general torpor and debility, with defective powers of nutrition, and assimilation; without inflammation of the stomach; or too great general plethora. It is used extensively in phthisis pulmonalis, the various forms of scrofula, cutaneous diseases, chronic rheumatism, marasmus, rachitis, &c.

How may it be administered?—Either by itself or in porter or ale, or in the juice of the sweet orange, or in combination with tinct. gent, and card. comp. The dose is a teaspoonful for a child, and a tablespoonful for an adult, three times per day.

PURE BITTERS.

What are the peculiar characteristics of the pure bitters?—They are less stimulant than the others, and more purely tonic.

QUASSIA.—What is this?—The wood of the quassia excelsa and simaruba amara, trees of the West Indies.

How is it kept in the shops, and how does it come to market?—It comes in billets, but is kept in shavings or raspings.

What are the properties of the wood?—The texture is fibrous, the colour is yellow, but becomes dark by exposure; it is inodorous, and of a bitter taste.

What is its active principle, and to what does it impart its virtues?—The active principle is quassin, and it imparts its virtues to water and alcohol.

What are its effects upon the system, and for what is it used?—It is a simple tonic, and is used in convalescence from acute diseases, in impaired digestion, and general debility of the system.

In what form is it used, and what is the dose?—In infusion, made with ʒij. to Oj. of cold water; dose, f℥ij. three or four times a day; extract, grs. ij.; tincture, fʒj.–f℥ij.

Gold Thread (*Coptis*).—What is this? (Fig. 333.)—The root of the coptis trifolia, which grows in the United States.

Fig. 333.

What is the appearance of the root, and to what does it impart its virtues?—It is in threads, yellow in colour, and imparts its virtues to water and alcohol.

What is the dose used?—Similar to quassia.

Gentian.—What part is used?—The root of the gentiana lutea, (Fig. 334,) which grows in the Appenines, Pyrenees, and Alps.

Describe this medicine.—It is brought to market either in longitudinally or transversely sliced pieces, twisted and wrinkled, grayish-brown externally and yellowish within, and of a soft spongy texture. The powder is dirty-yellow.

What are its sensible properties, and to what does it yield its virtues?—It has a feeble and peculiar odour, the taste is sweetish bitter, and it yields its virtues to water and alcohol.

In what cases is it used?—In the same as the preceding articles.

How is it used, and what are the doses?—In powder, grs. x.–xl.; infusion, made ℥ss. to Oj. water; dose, f. ℥ij.; compound infusion and tincture, of each the dose is f ʒj.–f ʒij.; extract, gr. v.–xxx.

In what was this a chief ingredient?—In Portland powder.

Does not the infusion ferment when kept too long?—Yes.

Fig. 334.

American Centaury (*Sabbatia*).—What is the name of the plant from which this is derived, and what part is used?—The whole of the plant Sabbatia angularis, which is indigenous. It should be collected when in bloom.

What is its appearance?—It has an annual, herbaceous, fibrous root, with an erect, smooth, four-sided stem, rising one or two feet in height; the leaves are considerable in length and width, ovate, acute, entire, and nerved; the flowers are numerous.

What are its sensible properties, and to what does it impart its virtues?—It is a strong and pure bitter, and imparts its virtues to water and alcohol.

In what cases is it applicable?—In the same as the preceding articles, also in intermittent fever.

How is it given, and what is the dose?—In infusion, ℥i. to Oj. of water; the dose is f℥ij.

Columba (*Colombo*).—What is this?—The root of the Cocculus palmatus, a plant growing in Mozambique and the south eastern coast of Africa.

What is the appearance of the root when it reaches us?—(Fig. 335. p. 694.)—It is in slices; the cortical portion is bright yellow and slightly greenish, and covered with a brownish, wrinkled cuticle; the medullary portion is light spongy yellow, more or less shrunk, and marked with concentric circles and radiated lines.

What is the odour and taste, and to what does it impart its virtues?—It has an aromatic odour, and the taste is bitter; it imparts its virtues to water and alcohol.

Fig. 335.

What is the colour of the powder?—It has a greenish tinge, which becomes brown by exposure.

What are its chief ingredients?—Colombin, starch, mucilage, and volatile oil.

In what cases is it used and what are its peculiar tonic properties?—It is used in the same cases as quassia, &c., and is peculiarly mild and unirritating to the stomach, and especially useful as a tonic in dyspepsia.

How is it used, and what are the doses?—In powder, grs. x.—xxx.; infusion, made ℥ss. to Oj. of water; dose, f℥j.–f℥ij.; tincture, fʒss.–fʒj.

What is the objection to the infusion?—It undergoes spontaneous change from the presence of starch.

BITTERS OF PECULIAR PROPERTIES.

PERUVIAN BARK (*Cinchona*). — Whence is this derived? (Figs. 336, 337.) — From the bark of the different species of cinchona, a

Fig. 336.

native of the Andes in South America, extending from La Paz in Bolivia to Santa Martha on the north coast.

What are the officinal varieties? — The pale bark (Cinchona pallida); the yellow bark (Cinchona flava); the red bark (Cinchona rubra).

Under what name do the other varieties go?—Carthagena barks.

Which are the pale barks, and describe them? — The commercial Loxa and Lima barks, which come to market in pieces of various sizes, singly and doubly quilled; the finer varieties are about the size

Fig. 337.

of a goose-quill; externally they are more or less rough, and of a grayish colour; internally they are smooth and velvety, but in the coarser kinds they are rough and ligneous; the colour is brownish-orange. The colour of the powder is pale fawn.

What are their sensible properties?—Their taste is bitter and moderately astringent, and the better kind have an agreeable feeble odour.

What is the chemical characteristic of the pale barks?—They contain a larger proportion of cinchonia than of quinia.

What is the yellow bark called in commerce?—Calisaya bark (this is different from the common yellow bark).

What are the forms of this variety?—The quilled and the flat.

Describe these varieties?—The quilled bark is in pieces of various lengths and thicknesses; the epidermis is brownish, with yellow lichens upon it; it is covered with fissures and wrinkles, which surround the quills; it is of a fibrous texture, and, when broken, presents shining, yellow, transparent points. The flat bark comes in larger pieces; destitute of epidermis; it has a yellowish colour both inside and out; it is more fibrous than the quilled, less compact and less bitter; the powder is between an orange aud a brown in colour.

What are the sensible properties of this variety?—It has a strong bitter taste, with little astringency, and a faint odour.

What is the peculiarity of this variety of bark? — It contains more quinia than cinchonia; and hence is the best.

What are the varieties of the red bark, and describe them? — The quilled and the flat; some entirely rolled, some partially; the quilled are in pieces, which vary in size and thickness; the flat variety is often very large and thick, and covered with a reddish-brown or gray epidermis, which is rugged and wrinkled, and often covered with warts; there is a dark-red, brittle, compact, fibrous layer beneath the epidermis, which has some bitterness and astringency; the colour of the powder is reddish-fawn.

What are the sensible qualities of the red bark, and how is it characterized? — It has a bitter and astringent taste; the odour is similar to that of the other good barks; it is characterized by containing equal quantities of quinia and cinchonia.

What are the varieties of the Carthagena barks? — The yellow Carthagena or common yellow bark, the brown, and the red.

What is the general appearance and taste of all the Carthagena barks? — They have a white, micacious appearance of epidermis, with a taste less bitter and more nauseous than the officinal varieties.

What is the proportion of quinia and cinchonia in this variety, compared with the officinal varieties? — It contains less of these than the officinal do.

What are the active principles of bark? — Quinia and cinchonia, combined with kinic acid. They also contain tannin and colouring matter.

What two other principles have been lately discovered?—Quinidia, and quinoidia. The former of these is procured by precipitating a solution of one of its salts by an alkali. It is in hard, shining, colourless crystals, and, when powdered, it is snow-white. It is scarcely soluble in cold water, and slightly so in boiling. It has a less bitter taste than quinia; it is dissolved by alcohol, and not so readily by ether; it is much less soluble in ether than quinia, and much more soluble in it than cinchonia; quinoidia, also called quinoidine, and amorphous quinia, is uncrystallizable. It is obtained from the mother liquors of the sulphate of quinia, by the addition of an alkaline carbonate. It is thought to be a mere modification of quinia. It is amorphous; has a yellowish-white or brownish colour, and very bitter taste. The sulphate of quinidia may be used in similar cases and doses with the sulph. quinia.

Cinchonia. — What are the properties of cinchonia? — It is a white, crystalline substance, almost insoluble in cold water, soluble in boiling alcohol, slightly soluble in ether and the fixed oils, and is less bitter than quinia.

Quinia. — How is quinia obtained? — By treating its sulphate with the solution of an alkali; collecting the precipitate, and washing

it till the water comes away tasteless; then drying it, and dissolving it in alcohol at 97° Fahrenheit, and slowly evaporating the solution.

Decribe quinia.—It is a whitish, flocculent powder, not crystallizable like cinchonia, but it may be crystallized in pearly, silky needles; it is fusible, intensely bitter, insoluble in water, soluble in alcohol and ether, and the fixed and volatile oils.

With what acids of difficult solubility do these alkalies form salts? —With the tartaric, oxalic, and gallic.

What are the incompatibles of bark?—The alkalies, alkaline earths, astringent infusions, &c.

How is bark most powerful?—In substance; but it nauseates and vomits in this form.

What are the effects of bark upon the system?—Tonic and anti-intermittent. In small doses it acts like simple bitters; in larger it purges; and in still larger, constipates and nauseates.

In what cases is it peculiarly applicable?—In all intermittent diseases where there does not appear to be much increased action of the pulse, or irritability of the brain.

What is the dose of the bark?—ʒi., repeated so that from ℥i. to ℥ij. may be taken between the paroxysms of an intermittent fever.

How is the infusion and decoction made, and what are the doses? —The infusion, with ℥i. to Oj. of boiling water; the decoction, ℥i. to Oj. of water, and boil ten minutes in a covered vessel; dose, f℥ij. three or four times a day.

How is the compound infusion made?—With ℥i. of bark to Oj. of water, with fʒi. of sulph. acid. arom.; the dose is f℥ij.

What are the ingredients of the tr. cinch. comp., and its dose?—Bark, orange peel, serpentaria, saffron, red saunders, and alcohol. The dose fʒj. to f℥ss.

What are the other preparations and doses?—The tincture, dose fʒi. to f℥ss.; extract, dose grs. x.–xxx.; sulph. quinia, and sulph. cinchonia.

Sulphate of Quinia.—How is this prepared?—By taking calisaya bark, lime, sulphuric acid, acohol, and animal charcoal and distilled water; boil the bark with the water acidulated, filter the liquor, then add lime, while constantly stirring; then wash the precipitate with distilled water; then dry and digest it with heated alcohol, and repeat the process till the alcohol is no longer bitter; mix the tinctures, and distil the alcohol till a brown, viscid liquid remains in the retort; then add sufficient diluted sulph. acid to saturate it; then add the animal charcoal; and, after evaporating sufficient liquor, filter it, and set it aside to crystallize.

What is the character and taste of the crystals?—Fine, silky, flexible, and intensely bitter.

In what is it soluble?—It is slightly soluble in cold water, more so in boiling water, and soluble in alcohol and ether; the dilute acids favour its solubility.

How much sulph. quinia is equal to an ounce of bark?—Grs. viii.

Why is the sulphate of quinia preferable to bark in substance? — Because it does not disgust the patient or sicken him in the same manner as bark, it is also more convenient for the administration of large doses, and as a simple tonic is much to be preferred.

What are the doses of it? — As an anti-intermittent, gr. i. – ii. every hour or two between the paroxysms; as a tonic, gr. $\frac{1}{4}$ – gr. $\frac{1}{2}$, three or four times a day.

How is it given?—In pill and solution.

How has the sulphate been adulterated, and how may you detect the adulterations? — It has been adulterated with lime, sugar, mannite, starch, and stearine, Epsom salts, &c. These may be detected by noticing the solubility of the sulphate in different menstrua, by the

Fig. 338.

chemical relations to other substances; the presence of any mineral substance not readily volatilizable may be detected by exposing the sulphate of heat, when all the sulphate will be driven off.

What are the peculiarities of the sulphate of cinchonia? — The crystals are larger and more soluble than the sulph. quinia, and it has a peculiar bitter taste.

Dogwood (*Cornus Florida*). (Fig. 338, p. 699.) — What part of this is officinal?—The bark of the branches and of the root.

Is this tree exotic or indigenous? — Indigenous.

What is the appearance and sensible properties of the bark?—The bark is reddish-gray and brittle, the epidermis is fawn-coloured, the powder is reddish-gray, it has a feeble odour and a bitter astringent aromatic taste.

To what does it yield its virtues?—To water and alcohol.

What are its effects upon the system? — Similar to those of cinchona.

How is it used, and what are its doses?—In powder, the dose ʒj.; in decoction, made ℥j. to Oj. of water, dose f℥j.–f℥ij.

Prunus Virginiana, or Wild Cherry Tree Bark. — Where is the tree found? — In this country.

Whence is the bark obtained? — From the stems, branches, and root.

Fig. 339.

What is the appearance of the bark in market?—It is in pieces of various sizes, curved, and of a lively cinnamon colour, brittle and pulverizable; the powder is fawn-coloured, and darkens by exposure.

What is its odour and taste, and to what does it impart its virtues? — The odour is that of peach blossoms, the taste is bitter and aromatic; it imparts its virtues to water and alcohol.

What are its active principles? — Hydrocyanic acid, tannic acid, and bitter extractive matter.

What effect has heat upon it?—It drives off the hydrocyanic acid.

What are its effects upon the system, and in what cases is it used? — It is tonic and sedative, and is beneficial in cases of debility conjoined with irritability of the circulatory and nervous systems, and is applicable in cases of pulmonary disease, hectic and intermittent fevers, &c.

In what form is it used, and what are the doses?—In powder, dose ʒj.–℥ss; cold infusion, made with ℥ss. to Oj. of water, dose f℥ij. three or four times a day. Syrup. dose ʒi.

CHAMOMILE (*Anthemis*).—The flowers of what plant is this? (Fig. 339, p. 700.) — The anthemis nobilis, an European plant.

Which flowers are the best, the single or the double?—The single.

What are their sensible properties, and to what do they impart

Fig. 340.

their virtues?—They have a fragrant, peculiar odour, and bitter, pleasant taste, and impart their virtues to water and alcohol.

What are their active principles?—Bitter extractive and volatile oil.

In what cases are they used?—They are mild, tonic, and are used in dyspepsia, intermittent fever, &c.

How are they used?—In cold infusion, ℥j. to Oj. of water, the dose is f℥ij. several times a day.

Thoroughwort (*Eupatorium*).—What part is used? (Fig. 340, p. 701).—The whole of the plant eupatorium perfoliatum, or boneset, an indigenous herb.

Fig. 341.

What are its sensible properties, and to what does it impart them?—It has a faint odour, strongly bitter and peculiar taste, which it imparts to water and alcohol.

What are its medicinal properties, and for what is it used?—It is tonic and diaphoretic, and in large doses an emetic and aperient; it is used in remittent fevers, catarrhs, rheumatism, &c.

As a tonic how is it used, and what are the doses?—In powder, the dose is grs. xx.–xxx., every two or three hours; cold infusion, made ℥j. to Oj. of cold water; dose, f℥j.–f℥ij. every three or four hours.

Virginia Snakeroot (*Serpentaria.*)—What part is used? (Fig. 341.)—The root of the Aristolochia serpentaria, an indigenous herbaceous plant.

What is the appearance and sensible properties of the root?—It is in tufts of long, slender, interlaced fibrils, attached to a head; it has a yellow colour when fresh, but becomes dark by exposure; the powder has a grayish tinge. It has a camphorous and aromatic odour; the taste is warm, bitter, and camphorous.

What are its active principles, and to what does it impart its virtues?—Its active principles are a bitter principle and volatile oil; it imparts its virtues to water and alcohol.

What are its effects upon the system?—It is a stimulant tonic, and also diaphoretic and diuretic, and in large doses vomits, it is used in all cases where a slightly stimulating action is needed to be conjoined with a tonic.

How is it used and what are the doses?—In powder, the dose is grs. x.–xxx.; infusion made, ℥j. to Oj. of warm water, dose, f℥j.–f℥ij. every 2 or 3 hours; tincture, the dose fʒj.–fʒij.

Myrrh (*Myrrha*).—What is this?—The gum or extract of the Balsamodendron myrrha, a small stunted tree of Arabia and North East Africa.

What are the varieties of this formerly known?—The India and the Turkey. The turkey is the best, both varieties are now known to be obtained from India.

What is the appearance of myrrh and its sensible properties?—It is in small, irregular fragments, of various sizes, sometimes agglutinated together; it is translucent, of an orange colour; the powder is brownish-yellow, the fracture is shining; it has a strong, peculiar, fragrant odour, and bitter aromatic taste.

What is it chemically?—A gum resin, with volatile oil, the active principles are myrrhin and the oil.

To what does it yield its virtues?—Partially to water, alcohol, and ether.

What effect has distillation upon it?—It drives off the volatile oil.

What are its effects upon the system?—That of a stimulant tonic, with a tendency to the lungs and uterus, and has been employed as an expectorant and emmenagogue in debilitated states of the system, where there is no febrile excitement present, or acute inflammation.

How is it used, and what are the doses?—In powder and pill, dose, grs. x.–xxx.; tincture, dose, fʒss.–fʒj.

Why are the tinctures of the gum resins made with undiluted alcohol?—Because in the absence of water a better preparation is made.

Cascarilla.—What is this?—The bark of the Croton eleutheria and cascarilla, shrubs growing in the West Indies and imported from Eleutheria.

What is its appearanee and sensible properties?—It is in small pieces, thin and curved in its length, with sometimes the woody fibre attached. It has a dull brown colour, an aromatic odour, which is like musk when burnt; the taste is warm and spicy bitter.

What are its active principles, and to what does it impart them?—Its active principles are bitter extractive cascarillin and volatile oil, and it imparts them to water and alcohol.

What are its effects, and when used?—It is a stimulant tonic, and

is employed in dyspepsia, chronic diarrhœa, dysentery, and flatulent colic.

How is it used, and what are the doses?—It is used in powder, dose, grs. x.–xxx.; infusion, made with ℥j. to Oj. of water, dose, f℥ij.

AROMATICS.

What are aromatics?—Substances having a fragrant odour, spicy taste, and containing volatile oil.

What are their effects upon the system, and in what circumstances are they used medicinally?—They produce warmth in the stomach, increase the frequency of the heart and arteries, and cause a general warmth over the whole body. They have no direct tendency to the brain, or influence over the secretions. When applied locally they stimulate the part actively. They are used as cordial stimulants to the stomach and bowels, in debility and flatulence. They relieve nervous uneasiness, and pain in the stomach and bowels; they are also anti-emetic. They are contra-indicated in inflammation of the stomach in a high febrile state of the system; they are generally administered as adjuvants to other remedies, &c.

What are the pecularities of the volatile oil?—They have an odour like the articles from which they are derived, they are hot, pungent, and spicy to the taste, easily volatilized, very inflammable, soluble in water, alcohol, and ether, and fixed oils, and become dark by exposure.

How are they prepared?—By distillation.

How can you detect their adulteration with any fixed oil?—By the want of a permanent stain on paper, when dropped upon it, and by the insolubility of the fixed oils in alcohol.

Orange Peel (*Aurantii Cortex*).—What is the part used?—The rind of the fruit of the Citrus aurantium and vulgaris.

What are the varieties in the market, and in what do their virtues consist?—We have the bitter or Seville orange, or citrus vulgaris, and the sweet; their virtues reside in the outer rind or yellow portion.

What are the sensible qualities, and to what does it impart them?—It has a grateful aromatic odour, and warm bitterish taste; the rind of the Seville orange is more bitter than the other; both impart their virtues to water and alcohol.

For what is it used?—As an adjuvant to other tonics, to impart a pleasant flavour and prevent griping.

How is the infusion, the confection, and the water made?—The infusion, by adding ℥ss. to Oj. of water; the confection from the fresh rinds, by bruising them, with sugar, and the water is made, by distillation, from the blossoms.

Cinnamon (*Cinnamomum*).—What is this?—The prepared bark

of the Zeylanicum cinnamomum or cassia, (Fig. 342,) a tree, native of Ceylon, and which grows also in Sumatra, &c.

Fig. 342.

How is it prepared?—By making longitudinal incisions in the tree, and removing the bark, rolling it into quills, and then into bundles, &c.

What are the two varieties?—The Ceylon and the China. The Ceylon is the best.

What are the sensible properties of cinnamon?—It has a light, brown-yellow colour; the colour of the powder is yellow-orange; it has a splintery fracture, and a pleasant fragrant odour, and a warm, aromatic, and pungent, sweetish taste.

What are the active principles?—Volatile oil and tannin.

What are the sensible properties of the oil?—The same as those of cinnamon itself, without its astringency.

How is cinnamon given, and what are the doses? — In powder, gr. ix.–xxx.; infusion made with ʒi.–ʒij. to Oj. of water; dose, f℥i.

What are its uses? — Those of aromatics generally.

How is cinnamon water made?—By rubbing the oil with magnesia, and adding water.

What preparations of it are officinal?—The tincture and compound tincture; the dose of each is fʒi.

Canella.—What part of canella alba is officinal? — The bark of the branches.

Where is the tree native? — In the West Indies.

What are the characteristics and properties of the pieces? — The pieces are partially or completely quilled, and of various sizes; they have a short fracture, and a pale orange colour; the powder is yellowish-white; they have an aromatic odour and warm, bitterish taste, and yield their virtues partly to water and all to alcohol.

Fig. 343.

What are the active principles?—Volatile oil and bitter extractive.

What are its medicinal effects? — Those of a local stimulant and tonic, producing a warmth of the stomach, and is beneficial in debilitated conditions of that organ.

What other bark is similar to this in property, and has been used in similar cases?—Winter's bark.

In what powder is it an ingredient? — In the powders of aloes and canella, or hiera-picra.

Cloves (*Caryophyllus*).—What are these? —The dried, unexpanded flower-buds of the caryophyllus aromaticus (Fig. 343), an evergreen tree, a native of the Moluccas.

What is the appearance and sensible properties of the clove? — It resembles a nail in shape, half an inch in length, with a rounded head, and four spreading points beneath it; externally, it is deep brown;

internally, reddish; the powder is reddish-brown, the odour and taste are pungent and aromatic.

To what do they impart their virtues?—To water and alcohol.

What is the active principle?—A volatile oil, which may be procured by distillation, by adding a little salt to the water.

How are they used, and what is the dose?—In powder, dose grs. v.–x.; infusion, made ʒij.–Oj. of water; dose, f℥ij.; the oil, dose, gtts. ij. to v.

Nutmeg (*Myristica*).—What is this?—The kernel of the fruit myristica moschata (Fig. 344), a tree growing in the Moluccas and in Brazil.

Fig. 344.

How is this obtained?—When the fruit becomes ripe it opens and discloses a reticulated membrane, which is the ordinary mace, beneath which we have a brown shell covering the nutmeg.

How is the mace and nutmeg prepared?—The mace is prepared by taking off the exterior covering of the fruit; then separating the mace and drying it. The nuts are dried in the sun till the kernel

rattles in the shell; the shell is then broken, and the kernel steeped in lime and water, and packed.

Describe the nutmeg and its sensible properties?—It is of a round or oval shape, marked with furrows, the size of a hickory nut; grayish in colour, and hard and smooth to the touch, and, when broken, has a variegated yellowish surface, and aromatic odour; it is easily pulverized by grating; it contains a volatile and fixed oil—or oil of mace.

Describe the mace.—It is a flat membrane, irregularly slit, smooth, soft and flexible, of a reddish-orange colour, and is used for the same purposes as the nutmeg.

How is the oil of mace obtained, and what is its appearance?—By bruising nutmegs in a heated mortar, and compressing them between hot plates; it has a yellowish-orange colour, and is in consistence thick.

What are the medicinal qualities of nutmeg and mace?—Aromatic and slightly stimulant narcotic, and are used chiefly as an adjuvant to other medicines, and as a condiment.

How is nutmeg used, and what is the dose?—In powder, dose, grs v.–xx.; volatile oil, gtts. ij.–iij.

Black Pepper (*Piper*).—What is the part used?—The dried berries of the piper nigrum, a vine growing on the coasts of Malabar, in Cochin China, &c.

What are its constituents?—Volatile oil, and an acrid, concrete oil, and white crystalline principle, called *piperin*.

What are its uses?—As a slight stimulant to the stomach, and chiefly as a condiment.

Cubebs (*Cubeba*).—What part is officinal?—The dried fruit of the piper cubeba, a vine growing in the East Indies.

What are the appearances and sensible properties of cubebs?—They are round, the size of a pea, grayish-black in colour, furnished with a short stalk, which is continuous with a reticulated covering, which embraces the berry like a net; the shell of the berry is hard, ligneous, and contains within it a single loose seed, covered with a blackish coat; internally, white and oleaginous; the odour is aromatic, the taste warm and camphorous; time deteriorates them.

What is the active principle?—A volatile oil; there is also an acrid resin and cubebin.

What are their medicinal properties and uses?—They are aromatic and diuretic, and are used in gonorrhœa and chronic catarrh of the bladder.

How is it given, and what are the doses?—In powder, dose, ʒss.–ʒiss., three or four times a day; volatile oil, in emulsion, gtts. x.–xx., and in an etherial or fluid extract, gtts. x.–xv. two or three times a day.

Cardamom (*Cardamomum*).—What is this?—The fruit of the Elettaria cardamomum, a plant growing in Malabar.

What is the appearance of the fruit and its sensible properties? (Fig. 345.)—It is in capsules, with three sides, and from three-fourths to one-half inch in length; these capsules contain dark-coloured seeds; they have a pungent aromatic odour, and a mild pungent taste.

Fig. 345.

a b c

In what do their virtues reside, and to what do they yield them?—They reside in a volatile oil, and they yield them to water and alcohol.

How are they used, and what is the dose?—Generally as an adjuvant to other medicines, or in infusion, made ʒij. to Oj. of water; dose, f℥i.–f℥ij.

What is the dose of the compound tincture?—Fʒi.

Fennel Seed (*Fœniculum*).—What are these?—The seeds of the fœniculum vulgare, an herb, a native of Europe, but cultivated in the United States.

What is the appearance and sensible properties of the seeds?—They are oblong, oval, flat on one side and convex on the other, slightly curved, and of a grayish-green colour and aromatic odour.

In what do their virtues consist, and to what do they impart them?—Their virtues consist in a volatile oil, and they impart them to water and alcohol.

How are they used?—In infusion, with ʒij. to Oj. of water. The oil is made by distillation, the dose is gtts. v.–xv.

Lavender (*Lavandula*).—What part of this plant is used?—The flowering spikes of the lavandula vera, a native of Europe, but cultivated in the United States.

In what do the virtues consist?—In the volatile oil.

What preparations of it are officinal?—The tincture, and compound tincture.

Of what does the compound tincture consist, and what is the dose?—Of the lavender, rosemary, cinnamon, cloves, nutmeg, and red saunders; the dose is fʒss.–fʒi.

Peppermint (*Mentha Piperita*).—What part of this is officinal?—The whole herb, which is a native of Europe, but cultivated in the United States. It should be collected when flowering.

What are its sensible properties, and to what does it impart them?—It has a penetrating, grateful odour, and an aromatic, warm, and pungent camphorous taste; it imparts its virtues to water and alcohol.

To what does it owe its virtues, and what are the sensible properties of the oil?—It owes its virtues to a volatile oil, which has the properties of the herb itself; the oil is lighter than water.

When alcohol is mixed with the oil, how will you detect it? — By its becoming turbid when mixed with water.

Fig. 346.

How is it used, and what are the doses? — In infusion, made ʒij. to Oj. of water; dose, f℥ii.; the dose of the oil is gtts. i.–iij.

How is the essence prepared? — By dissolving f℥ij. of oil in Oj. of alcohol.

How is the water prepared? — By rubbing the oil with magnesia, and adding water.

Ginger (*Zingiber*).—What part of this is used? Fig. 346.) — The root of the zingiber officinale, an herbaceous plant, native of the East Indies, and cultivated in the West Indies.

What are the two varieties and their characteristics? — The black ginger, and the white, or Jamaica; the black ginger is in pieces of different sizes, knotted and irregularly branched; externally it is of a light-ash colour, internally it is yellowish; the root is dug up when a year old, scalded and rapidly dried; the Jamaica ginger is prepared by depriving the root of its epidermis, and drying it.

What are its sensible properties, and to what does it impart them? — It has an aromatic, penetrating odour, and the taste is spicy, pungent, hot, and bitter; and it imparts its virtues to water and alcohol.

In what case is it used? — Internally in debilitated conditions of the stomach as a stimulant, and carminative, and is administered in dyspepsia, flatulent colic, and externally, as a rubefacient.

What are its chief ingredients? — Volatile oil, acrid resin, extractive matter, and starch.

In what forms is it used, and what are the doses? — In powder, dose, grs. x.–xxx.; infusion, made with fʒj. to Oj. of water, dose, f℥ij.; tincture, dose, fʒj.–fʒij., and syrup.

MINERAL TONICS.

Iron (*Ferrum*).—For the general history of iron, see *Chemistry*.

What are the medicinal effects of its preparations?—They are tonic

and astringent in small doses, improving the appetite, promoting digestion, and invigorating nutrition, and the whole system, but when used too long they induce plethora. They are consequently of benefit in debility, especially when connected in the female with some menstrual irregularity.

In what form is crude iron used?—In iron filings,—ramenta ferri —in the dose of from grs. v.–xx.—Squamæ ferri—scales of iron, prepared by heating a bar red-hot and pounding it, when the scales fly off, which are pulverized and levigated, and are of a grayish-white colour; dose, grs. v.–xx.

What is the powder of iron—ferri pulvis—Quevenne's iron?—Metallic iron prepared by passing hydrogen gas over sesquioxide of iron, heated to redness. The hydrogen abstracts oxygen from the sesquioxide and escapes as water, and the iron is left behind in a metallic state and then powdered. It is a dark iron-gray powder, without smell or taste. The dose is from grs. ij.–iij.–v. three times a day.

How is the rubigo ferri, or rust of iron prepared?—By taking iron wire in small pieces, exposing it to air and moisture, until it is covered with rust, which is to be rubbed in a mortar and prepared as the carbonate of lime.

Is it much used?—No.

Subcarbonate of Iron (*Ferri subcarbonas*).—What was this formerly called?—Precipitated carbonate.

How is it prepared?—By dissolving sulphate of iron and carbonate of soda in boiling water, washing the precipitate formed, passing it through bibulous paper, and drying it.

What is its form, sensible properties, and solubility?—It is a reddish-brown powder, of a slight styptic taste, soluble in the acids, and in water impregnated with carbonic acid.

What is its character as a chalybeate?—It is one of the very best, being safe, mild, and efficient in its action.

What is the dose?—Grs. v.–xx., three times a day, and in nervous diseases, ʒss.–ʒi., three times a day.

Proto-carbonate of Iron—Vallet's Ferruginous Pills (*Pilulæ ferri carbonatis*).—How is this prepared?—By dissolving sulphate of iron and carbonate of soda, each separately, in water, and adding to each solution syrup, then mixing the two solutions together in a bottle, just large enough to contain it, stop it well and set it aside, that the carbonate of iron may subside, then pour off the supernatant liquid, wash the precipitate with warm water sweetened with syrup, until the washings have lost their saline taste, press it between a flannel cloth, and then mix with honey; afterwards heat the mixture by a water-bath to a pilular mass, dose, grs. v.–xx.

What is its character as a chalybeate?—It is peculiarly adapted

to all cases when ferruginous preparations are indicated, especially in chlorosis, amenorrhœa, &c.

SULPHATE OF IRON (*Ferri Sulphas*) — GREEN VITRIOL. — (Chemical characters, see *Chemistry.*)—What are its sensible properties? — The crystals are bluish-green in colour, with a disagreeable styptic taste; they effloresce and absorb oxygen, and first become white, and afterwards yellow on the surface.

In what is it soluble? — In warm and cold water, and insoluble in alcohol.

What effect has heat upon it? — It causes it to undergo watery fusion, and become dry and white, &c.

What are its incompatibles? — The alkalies and alkaline carbonates; muriate of lime and baryta; the borates and phosphates; nitrate of silver; acetate of lead; tannic and gallic acids, &c.

What are its medicinal applications, &c.? — It is used as a tonic astringent, in large doses it is irritating to the stomach and bowels, and in very large doses poisonous.

What is the dose of the crystallized, dried, &c.? — Of the crystallized, grs. i. to v.; of the dried, grs. ss. to iij., three or four times a day.

What are some of the other preparations of iron?—The mistura ferri composita; tinctura ferri chloridi; the dose, ♏x. to xxx., three or four times a day; tartrate of iron and potassa, dose, grs. x. to xxx.; phosphate of iron, dose, gr. v. to x.; iodide of iron, in substance, grs. ij. to v.; solution and syrup, gtts. xv. to xl.; citrate of iron and quinia, grs. ij.–iij., three times a day, valerianate of iron, gr. i., three times a day.

COPPER — (*Cuprum*). —(General history, see *Chemistry.*)

Does metallic copper act upon the system? — It is uncertain.

What are the effects of the preparations of copper upon the system? — Tonic, acting particularly on the nervous system, and, in large doses, poisonous.

SULPHATE OF COPPER (*Cupri Sulphas*)—BLUE VITRIOL. (Mode of preparation, &c., see *Chemistry.*)

In what is this soluble? — In water; the solution is blue.

What is the effect of exposure upon the crystals? — They effloresce slightly,

What is its taste? — Strong metallic, and styptic.

What are its incompatibles? — The alkalies and alkaline earths, carbonates, borax, acetate of lead, iron, and astringent vegetable in fusions.

What is its dose?—One-fourth of a grain, given two or three times a day, in pill.

What are its effects upon the system? — In small doses, tonic and astringent; and in larger, emetic; and in larger still, poisonous.

In what cases is it used? — Internally in intermittent fever, in epilepsy, as an emetic for other poisons, and in chronic diarrhœa. Externally as an application to ill-conditioned ulcers, as an escharotic and styptic, and in ophthalmia, &c.

What are its poisonous effects, and the treatment for them? — We have a coppery taste in the mouth, black and bloody stools, irregular, sharp, and frequent pulse, cold sweats, cramps, convulsions, and death. The treatment: you must neutralize the poison by albumen in large doses, and magnesia; administer water and demulcents, excite vomiting, and use, if necessary, the stomach-pump, and counter-irritation over the stomach.

Ammoniated Copper (*Cuprum Ammoniatum*). — How is this prepared? — By rubbing together cupri sulph. et ammon. carb. in a glass mortar, and drying it on bibulous paper.

What is its colour and odour, and in what is it soluble? — It has a fine blue colour, ammoniacal odour, and is soluble in water.

For what is it used medicinally? — Epilepsy, chronic hysteria, worms, and in injection for gonorrhœa.

What are its incompatibles? — Potassa, lime-water, and the acids, &c.

What is the dose? — Gr. ss., twice a day.

Zinc (*Zincum*). — Is metallic zinc inert? — Yes.

What is the character of the preparations of zinc? — Mild tonics, similar in action to copper, but milder.

Sulphate of Zinc (*Zinci Sulphas*); White Vitriol. (Mode of preparation, &c., see *Chemistry*.)

What are the characters of this preparation? — It has a disagreeable, metallic, styptic taste; it is soluble in water, effloresces slightly in the air; and dissolves in its water of crystallization, when heated.

What are its incompatibles? — The alkalies and alkaline carbonates, hydrosulphates, and lime-water; and it precipitates in vegetable astringent infusions.

What are its medicinal properties, and in what cases is it used? — It is tonic, astringent, and, in large doses, a prompt emetic; is likewise used in obstinate intermittents, and in spasmodic diseases; externally as a styptic; also in gonorrhœa, leucorrhœa, and ophthalmia.

What is its dose? — As a tonic, gr. ss.–iij.; as local applications to mucous surfaces, gr. i.–ij. to f℥j. of water, &c.

What is the proportion of the acetate, in solution, for medical uses? — Gr. i.–ij. to f℥j. of water, &c.

Oxide of Zinc (*Zinci Oxidum*). — How is this made? — By adding together the sulphate, aqua ammon., and water, and taking the precipitate formed, and washing it, and then drying it by a sand-bath.

Describe this. — It is an inodorous, tasteless, white powder, soluble in the acids or ammonia, and not in water or alcohol.

In what cases is it used?—Internally as a tonic and anti-spasmodic; externally, as an application to excoriated surfaces.

What is the dose of it?—Grs. v.

What is the name of the ointment made from it?—Unguentum zinci oxidum.

For what is this used?—As an application in chronic ophthalmia, in cutaneous eruptions, sore nipples, &c.

What is the common name for the impure oxide?—Tutty.

ZINCI CARBONAS (*Calamine*); CARBONATE OF ZINC.—What form of this is most used?—The prepared carbonate, made by taking the carbonate, heating it to redness, pulverizing it, reducing it to fine powder, and washing it.

Describe it.—It is a reddish-yellow powder, with no odour, and a slight metallic taste; it is used chiefly for cerate.

What is the ordinary name for the Ceratum zinci carbonas?—Turner's cerate.

For what is it used?—In excoriations, superficial ulcerations, burns, old ulcers, &c., being a mild astringent.

ZINCI VALERIANAS (*Valerianate of Zinc*).—How is this prepared?—By saturating valerianic acid with the carbonate, or still better with pure oxide of zinc recently precipitated, and assisting the action by heat. Filter the hot solution, and crystallize in a gently-heated sand-bath. The crystals are light, pearly plates, of a brilliant white colour.

In what is it soluble?—It is moderately soluble in cold water, slightly more so in boiling water. Boiling alcohol is the best solvent. It is scarcely soluble in ether.

In what cases has it been used?—In epilepsy, neuralgia (particularly of the face and head), and in general nervous affections.

What is the dose?—From gr. ss.–ij., three times a day in pill.

BISMUTH (*Bismuthum*); SUBNITRATE OF BISMUTH (*Bismuthi Subnitras*).—(For preparation, see *Chemistry.*)

What is its form and sensible properties?—It is an insipid powder, of a pure white colour.

What are its medicinal effects, and for what has it been used?—It is tonic and antispasmodic, and has been used in epilepsy, cardialgia, pyrosis, gastrodynia, chronic inflammation of the stomach; in over doses it produces gastric distress, diarrhœa, vertigo, drowsiness, &c.

What is the dose?—From grs. iij.–x., in pill or powder.

What is the remedy in over-doses?—Mucilages internally, with emetics; and externally, counter-irritants, locally and generally.

SILVER (*Argentum*).—(See *Chemistry.*)

NITRATE OF SILVER (*Argenti Nitras*); LUNAR CAUSTIC.—(For preparation, &c., see *Chemistry.*)

How is this kept in the shops?—In sticks, and sometimes in white tabular crystals.

Describe it.—It is hard and brittle, of a gray colour, with a crystalline fracture; soluble in warm and cold water, and in boiling alcohol; it has an austere, metallic taste; light changes it to a dark colour, and heat decomposes it.

What are its incompatibles?—Common water, soap, the fixed alkalies and their carbonates, lime-water, the mineral acids, astringent vegetable infusions, &c.

What substance, on account of its incompatibility, is an antidote for its over-doses?—Common salt.

When taken internally for some time, what effect has it upon the skin?—It darkens it.

What is its character as a caustic?—It is mild and efficient.

What are its effects upon the system, and its uses internally?—It is tonic and astringent, and has been employed in epilepsy, chorea, angina pectoris, &c.; also in small doses in diarrhœa and dysentery. When too long continued it weakens the action of the stomach, and in large doses is a corrosive poison.

What is the dose of it internally?—Gr. ½, in pill or emulsion, three times a day, gradually increased.

What other preparations of silver have been used?—The chloride and oxide.

Sulphuric Acid (*Acidum Sulphuricum*).—(For chemical relations and preparation, see *Chemistry*.)

How is this used medicinally?—In a diluted state.

Dilute Sulphuric Acid (*Acidum Sulphuricum Dilutum*).—How is this prepared?—By adding gradually together sulphuric acid and water in a glass vessel.

What are its sensible properties?—It has a slightly sour taste and smell, and should be swallowed through a quill to prevent injury to the teeth.

What are its effects when internally administered?—It is tonic, astringent, and refrigerant, increasing the appetite when taken in small doses, but in large doses it is poisonous; it is used, in connection with other tonics, in night sweats, in chronic diarrhœa, passive hemorrhages, cutaneous affections, &c.

What is the dose?—Gtts. x.–xxx., three times a day in sweetened water.

What is the antidote for sulphuric acid in over-doses?—Magnesia, or a solution of soap, followed by mucilages and diluents.

Aromatic Sulphuric Acid (*Acidum Sulphuricum Aromaticum*);—Elixir Vitriol.—How is this prepared?—By mixing acid sulph., ginger, cinnamon, and alcohol together, digesting, macerating, and filtering them through paper.

What are its sensible properties and dose?—It is of a reddish-brown colour, aromatic odour, and, when diluted, a grateful acid taste; the dose is the same as the preceding.

In what cases is this used?—In the same as the preceding.

How is the sulphuric acid ointment prepared?—In the proportion of f ʒj. of acid to ℥j. of lard.

Nitric Acid (*Acidum Nitricum*).—Sp. gr. 1.5. (See *Chemistry.*)

What are its incompatibles?—The proto-sulphate of iron, carbonates, sulphates, and acetates of lead, and potassa, &c.

What is the treatment for over-doses?—Administer magnesia or soap in large quantities, and follow with mucilages, olive and almond oil, and use externally fomentations and counter-irritants over the stomach.

What are its effects upon the system?—It is tonic, refrigerant, and alterative, and, in over-doses, poisonous; it has been used, diluted, in low forms of fever, in syphilis, chronic hepatitis, &c.

What is the dose?—The strong acid, from gtts. ij.–v. in water.

What is Hope's camphor mixture?—A combination of nitrous acid, camphor water, and laudanum.

How is nitric acid used externally?—As a caustic, as a stimulant to old ulcers, and as an ointment.

Muriatic Acid (*Acidum Muriaticum*).—(See *Chemistry.*)—What are its incompatibles?—The same as the preceding.

What effects has this upon the system?—Similar to those of mercury; it stimulates the liver, and has been used in chronic hepatitis, in marasmus, dropsies, &c.

In what cases has chlorine water and gas been used?—In chronic bronchitis.

What is the dose of the acid?—Gtts. v.–xx. in f ℥iij.–f ℥iv. of sweetened water; and in gargle, f ʒi. to f ℥iv. of water.

Nitro-muriatic Acid (*Acidum Nitro-muriaticum*).—How is this prepared?—By mixing together one part of nitric acid and two parts of muriatic acid.

What are its effects upon the system, and when used?—It is tonic and refrigerant; when diluted it is used in fevers, in hepatic diseases, in syphilis, in phosphatic calculus diathesis, and as a gargle in scarlatina.

What is the dose?—Gtts. ij.–x., three or four times a day in water.

How is it used externally?—In baths, in the proportion of f ℥j. to cong. i. of water, temperature 96° Fahr.

What property has this acid?—That of dissolving gold, hence called aquæ regia.

STIMULANTS.

ARTERIAL STIMULANTS.

What are arterial stimulants? — Medicines which especially excite the circulation.

In what cases may they be administered? — In debility, during the course of any acute disease unaccompanied with inflammation, as a general rule, and also in cases of suppuration or gangrene, when the powers of life are low.

CAYENNE PEPPER (*Capsicum*). — What part is officinal? — The fruit of the capsicum annuum, which grows in the United States, but is not native.

Describe the fruit and its sensible properties, &c. — It is in long, conical, recurved pods; the surface smooth and red; internally, we have a medullary mass, and yellow-white seeds, in separate apartments; the powder is at first bright red, and then reddish-brown. It has an aromatic odour, and the taste bitter, hot, and pungent; it imparts its virtues to water and alcohol.

What is the active principle? — Capsicin.

What are its effects upon the system, and in what cases is it used? — It is stimulant, producing heat in the stomach, and a glow over the whole body; when taken in large quantities it causes inflammation of the alimentary mucous membrane; it is applicable in low forms of fever, as a gargle in scarlatina, as a stimulant in mania-a-potu, gout in the stomach, &c.

In what forms is it used, and what are the doses?—In powder, grs. v.–x.; infusion made with ʒij. to Oss. of boiling water; dose f℥ss.; tincture, dose, fʒj.–fʒij.

OIL OF TURPENTINE (*Oleum Terebinthinæ*). — What is the common name for this? — Spirits of turpentine. (See *Chemistry*.)

Describe it.—It is a limpid, colourless fluid, with a peculiar, penetrating, strong odour, and hot, pungent, bitterish taste. Sp. gr. 0·36, soluble in alcohol, ether, and slightly in water, and when exposed becomes thickened by absorbing oxygen.

What are its effects upon the system, and when applicable?—It is a stimulant, and healing diuretic, and anthelmintic, and in large doses cathartic, and when taken too largely produces giddiness; externally applied it is rubefacient; it is applicable in typhoid and typhous fevers, in diarrhœa, dysentery, yellow fever, peritonitis, &c.

What is its dose? — Gtts. v.–xx., every hour or two, in emulsion, with gum. acac. and sugar, to be suspended if strangury is produced.

PHOSPHORUS. — (See *Chemistry*.)—How should this be given? — In oleaginous and etherial solution; dose, gr. ss.

CARBONATE OF AMMONIA (*Ammoniæ Carbonas*). — (See *Chemistry*.)

Describe this, and its sensible properties, &c.—It is white, moderately crystallized, hard, transparent, with a pungent smell and sharp taste; soluble in water and insoluble in alcohol; and when exposed to the air becomes covered with a white powder, and becomes opaque, &c.

What are its effects upon the system, and when has it been used? —It stimulates both the circulatory and nervous systems, increases the secretions, &c., and has been used in low forms of fever, in retrocedent and atonic gout, and as an application to the bites of poisonous animals.

What is the dose?—Grs. v.–x., in emulsion, frequently repeated.

What other preparation of ammonia is in use?—The aromatic spirit.

NERVOUS STIMULANTS.

What are nervous stimulants?—Substances which have an exciting tendency upon the nervous system.

In what cases are they applicable?—Those of nervous derangement, uncomplicated with arterial excitement or inflammation; also in cases of morbid vigilance, dejection of mind, &c.

MUSK (*Moschus*).—From what animal is this derived?—From the Moschus moschiferous, a native of the southern mountains of Siberia.

From what part of the animal is this obtained?—From a sac on the belly, between the umbilicus and prepuce.

What is the appearance and sensible properties of musk?—It is in grains or lumps, of a reddish-brown colour, with a peculiar, strong, diffusible odour, and a bitter, disagreeable, acrid taste, and should be kept in well-corked bottles; it imparts its virtues to water and alcohol.

What are its effects upon the system, and in what cases used?—It is stimulating to the nervous system, and anti-spasmodic; it is applicable in cases of irregular nervous action, in typhous fever, singultus, infantile convulsions, &c.

How is it given, and what is the dose?—In pill or emulsion, dose, grs. v.; in tincture, ʒi.

How is artificial musk prepared?—By acting on amber with nitric acid.

CASTOR (*Castoreum*).—What is this?—The product of the Castor Fiber or Beaver; and it is derived from small bags situated between the anus and external organs of generation.

What are its sensible properties, and dose, &c.?—It has a strong, fetid, and peculiar odour, and bitter, acrid, nauseous taste, and more or less red colour. The dose, in substance, is from grs. x.–xv.; tincture, fʒi.–fʒij

ASSAFETIDA (*Assafœtida*). — What is this? (Fig. 347.) — The inspissated juice of the Narthex assafœtida, an herbaceous plant of Persia.

How is it kept in the shops? — In irregular masses, of a soft, consistence, becoming hard by exposure.

Give its sensible properties, &c.—The colour, externally, is yellowish or reddish-brown, and when broken it has an irregular, whitish, shining surface, and changes its colour by keeping; the taste is bitter and acrid; the odour fetid and durable; it softens by heat.

Fig. 347.

What is this chemically? — A gum resin, with volatile oil and bassorin.

To what does it impart its virtues? — To alcohol, and partly to water.

What are its effects upon the system, and its applications? — It is slightly stimulant, powerfully antispasmodic, expectorant, and laxative, and is applicable in hysteria, hypochondriasis, convulsions, in hooping cough, infantile catarrh, &c.

What are the doses of it? — Grs. v.–x., in pill or emulsion; in enema, f℥ss.–f℥ii., to Oj. of water; tincture, f℥i.; it is also used as a plaster.

VALERIAN (*Valeriana*).—What is the medicine used?—The root of the Valeriana officinalis; an herbaceous plant of Europe.

Describe this root and its sensible properties, &c. — It consists of long, slender, cylindrical fibrils, coming from a tuberculated head; externally they are yellowish-brown, internally white; the powder is

yellowish-gray; it has a strong odour in the old root; the taste is first sweet, and then bitter and aromatic; it yields its virtues to water and alcohol.

What are the active principles?—A volatile oil and an acid.

What are the sensible properties of the oil?—It is pale-greenish in colour, the odour is pungent, and has an aromatic taste, &c.

What are its effects upon the system, and when used?—It is a gentle stimulant to the nervous system; in large doses it causes pain in the head. It is used in cases of irregular nervous action, unaccompanied with inflammation, in hysteria, epilepsy, in the restlessness of the low forms of fever, morbid vigilance, &c.

How is it used, and what are the doses?—In powder, grs. xxx.–lx.; infusion, made with ℥i. to Oj. of water, dose, f℥ij.; tincture, fʒi.–fʒiv.; oil, gtts. iv.–vi., and repeated. The ammoniated tincture has also been used.

Oil of Amber (*Oleum Succini*).—What is the origin of amber?—It is supposed to be of vegetable origin, but is now found as a mineral in Prussia, on the sea-shore of the Baltic, &c.

Describe it.—It is a small, irregular lump, of a yellowish-brown colour, and, when pure, it is translucent and without taste or odour.

To what does it impart its virtues?—To water and alcohol.

What are the effects of distillation upon it?—It first yields a yellowish liquid, and then a yellowish oil, which becomes darker the more it is heated.

How is the impure oil rectified?—By distilling it with water.

What are the sensible properties of the rectified oil?—It is of a thin consistence, yellowish colour, and colourless when perfectly pure; the odour is strong and peculiar, and the taste hot and acrid; heat decomposes it.

To what does it yield its virtues?—To alcohol; sp. gr. 0·847, 55° Fahr.; in all proportions in absolute alcohol, and somewhat in water.

What effect has exposure upon it?—Turns it black.

What are its effects upon the system, and in what cases used?—It is stimulant and antispasmodic; it is used in hooping-cough and in singultus; externally it is used in spasmodic affections, by rubbing down the spine and over the bowels, &c.

What is the dose?—Gtts. v.–xv. in emulsion.

CEREBRAL STIMULANTS, OR NARCOTICS.

What are these medicines?—Those which, together with a stimulating action upon the whole circulation, exert a peculiar influence on the brain.

What are the effects of these medicines, as a general law, in large doses?—They are poisonous.

For what are they applicable?—As stimulants in low forms of fever, &c

ALCOHOL.—What is it the product of? — Vinous fermentation.

What are the fermented liquors? — Wine, brandy, whiskey, cider, perry, &c.

What does the distillation of these afford? — The distilled liquors.

What is proof spirit? — That of sp. gr. 0·920.

How is officinal alcohol obtained?—By the redistillation of distilled liquors — sp. gr. 8·35, and contains 15 per cent. of water.

For what is officinal alcohol used? — For the tincture of the gum resins, and the diluted for the tinctures of woods and leaves.

Of what does diluted alcohol consist? — Of equal parts of alcohol and water.

Which is the best distilled liquor for internal use? — Brandy.

How are wines produced?—From the juice of the grape by vinous fermentation. The Madeira, Teneriffe, and Sherry, are the best.

How do you make wine whey? — By adding from a gill to a half-pint of wine to a pint of boiling milk, straining without pressure, and sweetening the whey with loaf sugar.

SULPHURIC ETHER (*Æther Sulphuricus*).—How is this prepared? By distilling a mixture of sulphuric acid and ether. (See *Chemistry.*)

What are its properties? — It is a colourless, limpid liquor, with a strong and sweet odour, and hot, pungent taste.

What is its solubility in water and alcohol? — It unites with water in small proportions, and with alcohol in every proportion.

What are its effects upon the system? — It is a highly diffusible stimulant, increasing the circulation and heat of the body, and acting upon the brain, produces mental excitement, and, when inhaled, causing intoxication, and, finally, unconsciousness. Letheon or anhydrous sulphuric ether is used as an anæsthetic. It is applicable to cases of sudden prostration, nervous headache, in nervous affections void of inflammation, in singultus, and by inhalation in cases of asthma, chronic pectoral affections, &c.; externally as a rubefacient when evaporization is prevented.

What is the dose? — From f℥ss. to f℥j. in sweetened water.

What is the common name for the compound spirit of sulphuric ether? — Anodyne liquor of Hoffmann, or Hoffmann's anodyne.

How is this prepared? — By taking spts. æth. sulph. Oj., etherial oil f℥ij., and mixing them; its properties are similar to the preceding

How would you know it to be genuine?—By its being turbid when mixed with water.

In what cases is it used? — To allay irritation, want of sleep, restlessness, &c., when no inflammation is present.

What is the dose?—Gtts. xxx.–f℥j., in a wineglassful of sweetened water.

OPIUM.—What is this?—The concrete juice of the capsule of the papaver somniferum, and probably of the P. orientale.

What are the varieties of it, and where are they produced?—The white and black, produced in India, Europe, and partially in the United States.

What are the characters of the capsules?—They are smooth and glaucous, and rounded in shape, flattened at the top and bottom, and crowned with the persistent stigma; internally they are cellulated and filled with seeds.

What are the varieties of opium?—The Smyrna, Egyptian, and Constantinople; the variety generally used is the Smyrna.

What is the character of this variety?—It is in different sized pieces, deformed and flattened, and covered externally with seeds and leaves like the rumex; it blackens by exposure, and has a strong, virose odour, and a bitter, acrid taste.

Are there any essential differences in the Constantinople and Egyptian opium?—None, excepting their inferiority to the Smyrna; they possess all the qualities of opium, but in a smaller degree than the Smyrna. (See *Chemistry.*)

What is the colour of the powder of opium?—Reddish-brown; opium is best pulverized by drying it.

To what does it yield its virtues?—To water and alcohol.

Of what is opium composed?—Of morphia, narcotina, codeia, meconia, narceia, meconic acid, extractive matter, gum, &c. (See *Chemistry.*)

In what state does morphia exist in opium?—In the state of saline compound, combined with meconic acid, or as meconate of morphia.

What are the properties of narcotina?—It is a solid, tasteless, inodorous, white, crystallizable compound, fusible at a moderate temperature, insoluble in cold water, soluble in forty parts of boiling water, partially soluble in cold alcohol, soluble in ether.

How may it be separated from opium and morphia?—From opium by water, &c.; from morphia by sulphuric ether.

What are the effects of opium upon the system?—It is a stimulant narcotic. When taken by a person in health in moderate quantities it increases the force of the pulse, augments the temperature of the body, animates the spirits, &c.; it diminishes the peristaltic motion of the bowels, relieves pain and spasm. After taking a small quantity of it, there is a feeling of pleasure, followed by sleep. When taken in large doses, the soporific effect predominates, followed by debility, and, in larger still, we have the poisonous effects. In some patients it causes vomiting, delirium, wakefulness, want of appetite, tremors, itching, &c.

In what cases is it used, and when contraindicated?—As a stimulant in small doses in low forms of fever, to relieve pain, to relieve spasmodic action in tetanus, colic, nausea, diarrhœa, and in combination with a diaphoretic to increase the secretions. It is contraindicated in high states of inflammation, especially that of the brain, or

when there is a determination of blood to the head, &c. It may also be given by the rectum in strangury, uterine pain, violent vomiting, &c., locally to the eye, also in lotions to painful tumours, in ointment for piles.

What is the treatment for the poisonous effects of opium? — First evacuate the stomach, either by an emetic or the stomach-pump; dash cold water from a height upon the head; make the patient walk about, and administer stimulants, and, if necessary, keep up artificial respiration till the effects of the opium passes off; electricity and electro-magnetism have also been used; a strong infusion of coffee is an excellent antidote.

In what forms is it given?—In substance, dose, gr. ss.–i.; in tincture, and in the preparations of morphia.

What is the ordinary name of tinctura opii? — Laudanum.

How is it prepared?—By taking pulverized opium, ℥iiss.; alcohol, Oij.; macerate fourteen days, and filter through paper.

What is the dose equivalent to a grain of opium? — ♏xiij., or gtts. xxv.

What effect is produced by keeping it?—It becomes stronger.

What is the ordinary name for the tinctura opii camphorata? — Paregoric elixir.

What does this contain? — Opium, benzoic acid, ol. anisi, ext. glycyrrhiza, mel. disp., camphor, and alcohol.

What are its sensible properties? — It has a grateful, camphorous odour, and sweetish taste.

How many grains of opium are there in a fluidounce?—Two.

What is the dose?—F ʒi.

For what is the tinctura opii acetas a substitute?—The black drop.

How is it prepared? — By taking opium, ℥ij.; vinegar, f℥xxi.; alcohol, Oss.; macerating fourteen days, and filtering through paper.

What is the dose equivalent to a grain of opium? — ♏x. or gtts. xx.

Morphia. — How is morphia prepared? — By taking opium, distilled water and alcohol, and water of ammonia; macerating the opium with part of the water; filtering and washing with the residue of water; and again filtering, and then adding a small quantity of alcohol and the water of ammonia; setting it aside to crystallize; then purify it by boiling it with alcohol; then filter while hot, and crystallize.

What are its general properties?—It is in small, shining, colourless, inodorous, and bitter crystals, but loses the crystalline form when heated. It is insoluble in cold water, slightly soluble in hot; insoluble in cold, but soluble in boiling alcohol; soluble in the fixed and volatile oils, and insoluble in ether. It restores the blue colour of litmus, is reddened by acids, and with the acids forms salts, and with nitric acid forms a blood-red colour, &c.

How is morphia used? — In combination with an acid, as the sulphuric, muriatic, or acetic.

MORPHIÆ SULPHAS. — How is this made, and what are its properties? — It is made by saturating morphia with dilute sulphuric acid, and then evaporating and crystallizing the solution; it is in slender, white, soft, and silky crystals, generally kept in powder, and is soluble in water.

What is the equivalent of *morphiæ sulphas* to a grain of opium? — The one-sixth of a grain.

How is it given, and what is the officinal solution?—It is given in pill or solution; the officinal solution contains gr. i. to f℥i. of water

What is the dose of this solution?—From f ʒi.–f ʒij.

MORPHIÆ ACETAS. — What is its form and solubility? — It is in slender, needle-shaped crystals, united in bundles, and of easy solubility in water.

Is morphiæ murias officinal?—No.

What are the physiological effects of the preparations of morphia and their uses?—They are less stimulating than opium, and have not the same bad effects; they do not constipate, but when given in quantities not sufficient to produce sleep they cause uneasiness, or they can be used in cases where opium does not agree with the patient, their secondary effects also being less disagreeable than those of opium, they are beneficial in inflammatory and catarrhal affections, mania-a-potu, &c., externally in cancerous diseases, neuralgias, &c.

Are the salts of morphia ever applied externally? — Yes; sprinkled on blistered surfaces, &c.

LACTUCARIUM.—What is this, and what are its sensible properties, &c.? — It is the inspissated juice of the Lactuca sativa, or garden lettuce, which is absorbed from the broken stem by a sponge, and then pressed in a cup, and exposed until it becomes concrete; it is of a brownish colour, and of an odour and taste resembling opium; it yields its virtues to water and alcohol; it consists of a free acid, a narcotic principle, but contains no morphia.

What are its uses? — It is applicable to the same cases as opium, and when opium disagrees.

What is the dose?—Grs. ij.–iij.

HENBANE LEAVES (*Hyoscyami Folia*); HENBANE SEEDS (*Hyoscyami Semen*). — What are these? — The leaves and seeds of the Hyosciamus niger; an herbaceous plant, a native of Europe.

Describe the leaves and the seeds? — The recent leaves have a strong, disagreeable, aromatic odour, and mucilaginous acid taste; the dried leaves have little smell and taste; the seeds are small and yellowish; the virtues of both, which consist in a peculiar principle called hyosciamia, are imparted to water and alcohol.

What is the dose of the leaves?—Grs. v.–x.

Extractum Hyoscyami.—What is this?—The inspissated juice, prepared by bruising the fresh leaves, sprinkling with water, and expressing and evaporating the juice; it is of a soft consistence at first, but gradually becomes harder.

What are its sensible properties?—It is of a dark olive colour, with an unpleasant odour; and a bitterish, nauseous, and saline taste.

What are the effects of hyosciamus upon the system, and when used?—In moderate doses it gently accelerates the circulation, producing a general warmth of the surface and in the throat, causing sleep and sometimes pain in the head, dilatation of the pupil, in over-doses its effects are poisonous, irritating the alimentary canal and brain. It differs from opium in being laxative, it is used in catarrhal diseases, relieves pain, procures sleep, and quiets irregular nervous action.

What is the dose of the extract, and of the tincture?—The dose of the extract is from grs. ij.–iij.; tincture, dose, f℥i.

Hops (*Humulus*).—What are these?—The fruit or strobiles of the humulus lupulus; a vine; a native of Europe and America.

What are the characteristics of hops?—They are conical in shape, of a pale green colour, becoming dark by age, and consist of numerous scales, which contain, at the base, two black seeds, and a powder called lupulin; they have a strong, aromatic odour, and a bitter-astringent, aromatic taste, and impart their virtues to water and alcohol; the active principles are a volatile oil and a bitter principle, called lupulin.

What are the sensible properties of lupulin?—It is in a fine yellow powder, mixed with scales of the strobiles; and has the odour and taste of hops.

What are the effects of hops upon the system, and when used?—They are tonic, with a peculiar tendency to the nervous system, slightly narcotic, produce sleep, &c., they are used in dyspepsia, the nervous tremors of drunkards, &c.

In what forms are hops given, and what are the doses?—They are given in infusion, made with ℥ss. to Oj. of water; dose, f℥ij.; tincture, dose, fʒss.–fʒi.; they are also used externally, as a poultice, &c.

How is lupulin used?—In substance, dose, grs. vi.–xii.; in tincture, dose, fʒj.–fʒij.

Camphor (*Camphora*).—What is this?—The product of the camphora officinarum, an evergreen tree, growing in China and Japan.

How is it obtained?—By sublimation from the roots and smaller branches, which affords the impure camphor, which is again refined and presented in cakes of a circular form, from one or two inches in

thickness, convex on the one side and concave on the other, and perforated in the centre.

Describe camphor and its sensible properties, &c.—It is white and translucent, unctuous to the touch, bitter, and of a tenacious crystalline texture. It has a peculiar odour, bitter, pungent, cooling taste, lighter than water, and very volatile. At a moderate temperature it melts and is inflammable.

What are its relations to water and alcohol?—It is slightly soluble in water, soluble in alcohol, in ether, and the fixed oils. Water precipitates it from the tincture.

What are its chemical constituents? — Carbon, oxygen, and hydrogen.

How would you pulverize it? — By mixing it with alcohol.

What are the forms of administration, and the doses? — In substance, grs. v.–x.; in emulsion, made by rubbing it up with gum, sugar, and water; in camphor water, made by rubbing camphor, magnesia, alcohol and water together, the strength of it is ʒij. to Oj. of water. The dose is f℥j.–f℥ij.; tincture, made with camphor, ℥iv., to alcohol, Oij.; dose, gtts. v. to fʒj.

What are its effects upon the system, and in what cases is it used? — In moderate doses it is an arterial stimulant, it exhilarates the spirits, &c., in over-doses it causes nausea, vomiting, anxiety, faintness, vertigo, delirium, and sometimes death. It is used in typhoid diseases, as a nervine in rheumatism, spasmodic diseases, amenorrhœa, &c.

How and in what forms is it used externally? — It is used in the camphorated tincture of soap, the camphorated soap liniment, and the camphorated liniment.

What is the difference between the camphorated tincture of soap and the camphorated soap liniment?—The former is made with vegetable, the latter with animal oil.

Belladonna. — Of what is this the product? (Fig. 348.) — The leaves of the atropa belladonna, or deadly nightshade, an herbaceous plant, native of Europe.

What is the colour, odour, taste, and smell of the dried leaves? — They are of a dull greenish colour, faint narcotic odour, and sweetish, subacrid, slightly nauseous taste.

In what does its virtues reside? — In an alkaline principle, called *atropia*.

What are its effects upon the system and therapeutical uses? — It is a stimulant narcotic, acting upon the brain and nerves, it possesses also diaphoretic and diuretic properties. It is used in spasmodic affections, neuralgia, gout, rheumatism, whooping-cough, &c., and also as prophylactic in scarlatina, it has the power of dilating the pupil of the eye when applied around it, in substance, extract, or in fusion, (and, it is said, the os uteri also).

Fig. 348.

What are its poisonous effects upon the system, and antidote?—Dryness of the mouth and fauces; great thirst; difficult deglutition; nausea and vertigo; the pupils of the eye dilated and insensible to light; feeble pulse; cold extremities; convulsions, &c. The antidote is to evacuate the stomach and administer mucilages, ammonia, and lime water.

In what forms is it used, and what are the doses?—In substance; in infusion, made with ℈j. to f℥x. of water, dose f℥i.–ij.; the extract, dose, grs. ¼ to ½, twice a day: the dose at the commencement should be small.

In what other form is it used?—As a plaster and ointment.

Stramonium Leaves (*Stramonia Folia*), S. Root (*Stramonia Radix*), S. Seeds (*S. Semen*). (Fig. 349).—What is this?—The leaves, seeds, and roots of the datura stramonium, an annual plant, growing everywhere.

Describe the sensible properties, &c., of the leaves, seeds, and root.

Fig. 349.

— The odour of the leaves is strong and fœtid, with a bitter, nauseous taste. The seeds are small and kidney-shaped, dark-brown in colour, inodorous, and of a bitter, nauseous, acrid taste, and the most powerful part of the plant. The root is yellowish-brown, and has not as much power as either the leaves or the seeds.

In what does its active principle exist, and to what does it impart its virtues?—Its active principle is *daturia,* and it imparts its virtues to water and alcohol.

What are its effects upon the system, and its uses? — It is that of a powerful narcotic and stimulant, and is used in the same cases as belladonna, also for smoking in asthma, when there is no tendency to apoplexy, or affection of the heart.

What are its poisonous effects, and antidote? — They are similar to those produced by belladonna, and the antidotes are the same in both cases.

What are the forms of administration, and the doses? — In seeds, pulverized, dose, gr. j.; extract of the seeds, gr. ¼ to ½; powdered leaves, gr. j. Externally it is used in the form of an ointment.

Bitter Sweet (*Dulcamara*). — Of what is this the product? — Of the solanum dulcamara, or woody nightshade, a woody vine, growing in Europe and the United States.

Describe this and its sensible properties.—The twigs are of an ash-brown colour, consisting of a ligneous and cortical portion and pith, wrinkled externally; they emit, when bruised and fresh, a peculiar, rather nauseous smell; the taste is first bitter and then sweet.

In what does its active principle consist, and to what does it impart

its virtues?—Its active principle is *solania*, and it imparts its virtues to water and alcohol.

What are its effects and uses?—In large doses it is narcotic, and it increases the secretions from the skin and kidneys; in over-doses it causes nausea, vomiting, faintness, vertigo, convulsions; it is beneficial in cutaneous diseases, combined with tart. ant. et potass., in chronic rheumatism, &c.; it restrains also the venereal propensity.

How and in what forms is it given, and its dose?—In decoction, dose, f℥ij., four times a day; the extract is given in from grs. v. to x.

HEMLOCK LEAVES (*Conii Folia*); HEMLOCK SEED (*Conii Semen*).—Of what are these the product?—Of the conium maculatum, (Fig. 350), an umbelliferous plant, native of Europe, but naturalized in the United States.

Fig. 350.

When should the leaves be gathered, and what are their general characteristics?—They should be gathered when the plant is in flower, and quickly dried, and should be kept from the light and air. They have a green colour, heavy, narcotic odour, and a bitter, nauseous taste, and impart their virtues to alcohol, ether, and moderately to water.

Describe the seeds.—They are small, roundish, ovate, striated, and composed of two plano-convex, easily-separable parts; on the outer surface there are five crenated ribs.

What is the active principle? — Probably *conia.*

What are its effects upon the system, and its medicinal applications? — Narcotic in large doses, causing vertigo, dimness of vision, nausea, muscular debility; and, in still larger doses, dilated pupils, difficulty of speech, delirium, stupor, paralysis, convulsions, and death. It is used in scirrhous, cancerous ulcers, chronic rheumatism, goître, hooping-cough, &c.

When an over-dose has been given, what must be done?—Evacuate the stomach and bowels, and give mucilages.

In what forms is it given, and the dose?—In the powdered leaves, dose, grs. iij.–iv.; extract, dose, grs. iij., three or four times a day.

SEDATIVES.

ARTERIAL SEDATIVES.

What are these? — Medicines which reduce the vital action of the heart and arteries.

In what cases are they used? — In all inflammatory diseases attended with fever, and without a typhoid tendency.

Antimony (*Antimonium*).—(For chemical relations, &c., see *Chemistry.*)

Does metallic antimony produce any effect upon the system? — Yes, when powdered.

What are the effects of antimonials? — In small doses they modify the vital actions, in larger doses, without vomiting, they depress the force of the circulatory system, and, in larger doses still, they vomit, and, when not thrown off the stomach, they purge; they also stimulate the secreting functions; when applied externally they produce irritation.

Tartrate of Antimony and Potassa (*Antimonii et Potassæ Tartras*). — What is this chemically? — A double salt of the tartrate of potassa, and the tartrate of the sesquioxide of antimony.

How is this prepared? — By taking prep. sulph. ant., acid. hydrochlor., acid nitric and water; mix the acids together, and add the sulph. of antimony; digest the mixture with heat, and pour it into the water, and then set it aside to crystallize. See *Chemistry.*)

Describe the crystals, &c. — They are colourless and transparent when fresh, when exposed they become opaque, effloresce, and fall into a powder, which is inodorous, with a nauseous, styptic taste.

What are their relations to water and alcohol? — They are freely soluble in water, insoluble in alcohol; time decomposes the aqueous solution.

What are its incompatibles? — The mineral acids, the alkalies and their carbonates, sulphurets, lime-water, and the vegetable astringents.

What are its medicinal applications?—In small doses as an alterative

in chronic cutaneous diseases, in scrofula, in chronic pulmonary affections; in large doses as a refrigerant and arterial sedative in inflammatory affections.

What are its poisonous effects and antidotes? — First, we have an austere metallic taste; followed by nausea and vomiting, with hiccup, pain in the stomach, fainting, small, frequent, accelerated pulse, and the general symptoms of malignant cholera. The treatment is to evacuate the stomach, allay vomiting, give mucilages, following it with green tea, or infusion of bark, and support the strength, &c.

What is the dose? — As an alterative, gr. $\frac{1}{4}$ to $\frac{1}{2}$ daily; as a sedative, gr. $\frac{1}{8}$–$\frac{1}{2}$, or more; as an emetic, grs. i.–ij.

ANTIMONIAL WINE (*Vinum Antimonii*). — What is this? — A solution of tartar emetic in wine, in the proportion of grs. ij. to f℥j.

What is the advantage of this preparation?—It affords an excellent way of administering a minute dose, especially to children.

What is the dose? — As an expectorant, gtts. x.–xxx.; for children, as an emetic, gtts. xxx.–f ʒj.

ANTIMONIAL POWDER (*Pulvis Antimonialis*). — Of what is this an imitation? — Of James's powder.

How is it prepared?—By taking sulphuret of antimony, hartshorn shavings, mixed and placed in a crucible, heated to whiteness, and stirred till vapour ceases to arise (See *Dispensatory.*)

What are its sensible properties and dose? — It is of a white colour, inodorous; tasteless, and insoluble in water; dose, grs. iij.–viij.

NITRATE OF POTASSA (*Potassæ Nitras*). — (See *Chemistry.*)

How is it imported? — In a crude state, but is refined and crystallized after being received.

Describe it, and its sensible properties, &c.—It has a white, striated appearance, with a sharp, cooling, and slightly bitter taste; it is semi-transparent and inodorous, soluble in water, insoluble in alcohol.

Has it any water of crystallization, and what are the effects of heat upon it? — Water is mechanically present in it, moderate heat melts it, and red heat decomposes it.

What are its effects upon the system, and when used?—In moderate doses, frequently repeated, it lessens the force and frequency of the pulse, stimulates the secretions from the skin and kidneys, and diminishes the energy of the stomach. It may be administered in inflammatory diseases devoid of inflammation of the alimentary mucous membrane.

In very large doses is this not dangerous? — Yes.

What are the antidotes in over-doses? — Administer ipecacuanha, with mucilaginous drinks; tr. opii, to allay pain and irritation, &c.

What is the dose? — Grs. v.–x., in powder or solution, every hour or two; it is also given in combination with antimony and calomel.

What are the nitrous powders?—Potassæ nitras ʒi., ant. et. potass. tart. gr. j., hyd. c. mit. gr. vj., made in six powders.

Which are the principle vegetable acids used?—The citric and acetic. (See *Chemistry.*)

When are the vegetable acids used?—In cases of fever as a drink, when diluted with water.

How is citric acid prepared?—By saturating lemon-juice with carbonate of lime, the carbonate of lime is allowed to subside; it is then washed with water and decomposed by sulph. acid, and the citric acid remains in solution; this is concentrated in leaden boilers until a pellicle forms, and then crystallized, and recrystallized before used.

What is the strength of it in solution?—℥j.–Oj. of water; and for lemonade, ℈j.–Oj. of water.

NERVOUS SEDATIVES.

What are these medicines?—Those which, in their primary action, cause a reduction, both of the nervous powers and the force of the circulation.

Fig. 351.

In what cases are they applicable?—In nervous affections complicated with excitement of the heart and arteries.

FOXGLOVE (*Digitalis*).—What part is officinal? (Fig. 351.)—The leaves of the Digitalis purpurea, a biennial, herbaceous plant, native in Europe, but cultivated in the United States.

What are its characteristics?—The leaves are ovate, upper surface green, under surface paler and softer; they should be dried in the sunshine and kept separate, and excluded from air and light. The leaves, as prepared by the Shakers, are in oblong, compact masses; they should be collected in the second year.

What are their sensible properties?—They have a bitter, nauseous taste, and the powder is fine deep green.

To what does it yield its virtues?—To water and alcohol.

What are the effects upon the system, and medicinal applications?

—It is a narcotic, sedative, and diuretic, diminishing the frequency of the pulse, increasing the secretion of urine; given in large doses it causes weight and tightness, with dull pain in the head, vertigo, &c. It is used in hemoptysis, aneurism, hypertrophy of the heart, spasmodic asthma, epilepsy, &c. It should be used cautiously, as it may collect in the system, and thus act too vigorously.

When given in poisonous doses, what is its effect upon the system, and what is the antidote? — It nauseates and vomits, producing stupor and delirium, cold sweats, hiccup, convulsions, and syncope, &c. Antidotes are stimulants; as brandy, ammon. carb.; and if any digitalis is in the stomach, use diluents.

How is it administered, and what are the doses? — In powder, dose, in chronic cases, gr. i., morning, noon, and night; in acute cases, gr. ss. to one-fourth, every three or four hours; infusion, made with ʒi. to Oss. of boiling water, with f℥i. of tr. cinnam; dose f℥ss.; dose of tincture, gtts. x., equal to one grain of powdered leaves.

What is the active principle of digitalis?—Digitalin: It is in the form of a slighly yellowish powder, scarcely crystallizable, unalterable in the air, of a feeble, aromatic odour, intensely bitter taste; soluble with difficulty in cold and hot water, but soluble in alcohol and chloroform, and slightly so in ether. It is most easily given in sugar globules. One part of it is equal to fifty parts of good digitalis, and seventy-five of ordinary. The dose is one globule twice or three times daily.

Tobacco (*Tabacum*).—What part of this is officinal?—The leaves of the Nicotiana tabacum, native of tropical America.

To what does it impart its virtues?—To water and alcohol.

What are its active principles?—Nicotia and Nicotianin.

In what cases is it used by injection and externally?—In strangulated hernia, obstinate colic, painful spasm of the urethra, ureters, &c., externally it is beneficial as a poultice in spasm of the glottis, in croup, in colica pictonum, painful affections of the joints.

What is the strength of the infusion? — ʒi. to Oj. of water, one-half to be given at a time, by injection.

Hydrocyanic Acid (*Acidum Hydrocyanicum*); Prussic Acid. —(See *Chemistry*.)

In what plants does it exist?—In the kernel of the peach, in bitter almonds, in the cherry, and the laurel.

Describe this acid?—It is a transparent, colourless, volatile liquid, having a taste, first cooling, afterwards irritating; it has the odour of bitter almonds; it is decomposed by exposure.

How is it used?—In the diluted form, of the sp. gr. 0·998.

What are its effects upon the system, and in what cases has it been used? — It is a deadly poison, prostrating the nervous energies,

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causing loss of sensation, difficult respiration, coldness of the extremities, and death. It has been used in pulmonary affections, hypertrophy of the heart, dyspepsia, &c.

What must be done when its poisonous effects are produced?—Administer a strong emetic or purgative enemata, then stimulating liniments and mucilages should be used; and if cerebral congestion, bleed from the jugulars, and administer ammonia as an antidote.

What is the dose?—Of the concentrated acid, one-half of a drop; of the officinal, gtt. i., every two or three hours.

ACONITUM (*Aconite*).—Whence is this derived?—From the aconitum napellus, or monk's hood, or wolf's bane. It is a perennial herb, from two to six or eight feet in height, growing wild in the mountains of central Europe; it is also cultivated on account of the beauty of its spike-like racemes, of fine purplish-blue flowers. The leaves and the root are officinal.

Fig. 352.

Describe the leaves and the root. (Fig. 352.)—They are three or four inches in diameter, divided almost down to the base into wedged-shaped segments, having two or three lobes. They are somewhat rigid, of a deep green above, and light green beneath, and smooth and shining on both sides. When fresh, they possess a feeble narcotic odour, and at first a bitterish, and afterwards a hot acrid taste, and communicate to the mouth a numb, tingling sensation. Their virtues are injured by long keeping. The root is spindle-shaped, about an inch thick, and tapering; brownish externally, internally whitish and fleshy. The taste is first sweet, and afterwards acrid.

What is the active principle?—Aconitin or aconitia.

What are its effects upon the system?—It is a local irritant, and, in its general operation, a nervous sedative, as well as arterial

sedative. It sometimes acts as a diuretic and diaphoretic. When applied to the skin, it first irritates, and is then followed by prickling sensations and numbness. When given internally, in moderate doses, it produces a feeling of warmth in the stomach, and a general glow over the system, followed by prickling, and a sense of muscular debility. The force of the circulation and the number of respirations are diminished. In larger doses the above effects are exaggerated, and we have in addition, headache, giddiness, dimness of vision, &c. The pulse and the number of respirations are alarmingly diminished, and a general debility ensues. The phenomena remarked may take place in twenty or thirty minutes, and continue for some days. Its effects, like digitalis, may be cumulative. In poisonous doses, we have all the preceding symptoms magnified.

What must be done when taken in poisonous doses?—Evacuate the stomach, administer opiates and cordials to allay irritation, and use stimulants externally and internally, sometimes together with the electro-magnetic machine, to keep up, if possible, the action of the heart. Iodine has been suggested as an antidote.

What is its therapeutic application?—To allay arterial and nervous excitement. Hence it is beneficial in inflammations, active congestion, rheumatism, disease of the heart; in hemorrhages, especially of the lungs; in amenorrhœa, with chronic congestion or spasm of the uterus.

In what form is it administered?—In powder, gr. i.–ii., seldom thus used. The extract, or inspissated juice, gr. i.–ij.; alcoholic extract, gr. ss.–gr. j.; tincture of the root, gtts. iij.–v., gradually increased, three times a day.

What is the appearance of aconitia?—When pure it is white and uncrystallizable; it is inodorous and bitter, sparingly soluble in water, and readily in alcohol and ether. It may be employed in alcoholic solution, gr. i. to f ʒj. of alcohol; it is a highly dangerous remedy.

EMETICS.

What are emetics?—Medicines, in certain doses, and, as an ordinary result, capable of producing vomiting in the healthy state of the stomach.

For what purposes are they used, and when should they be avoided?—To evacuate the stomach, to cause pressure on the liver and other viscera, to produce muscular relaxation, to promote the secretions, for depletion, irritation, &c. They should be avoided in inflammation of the stomach, or other viscera, in determination of blood to the brain, in pregnancy, in hernia; they should be used with caution in paralysis of the stomach, &c.

How would you relieve hyperemesis?—By demulcent drinks, by morphia, or laudanum, or a spice plaster, and counter-irritation, and blistering, &c.; by an enema of laudanum in some mucilaginous infusion.

VEGETABLE EMETICS.

IPECACUANHA. — What is the part used? (Fig. 353.) — The root of the Cephaelis ipecacuanha; a small shrub, growing in Brazil and other parts of South America

Fig. 353.

Describe the root and its sensible properties. — It is of different lengths, and the size of a goose-quill—having annular rugæ, which are contorted and twisted, and consist of a ligneous and cortical portion; the cortical portion is hard, horny, and semitransparent, and breaks with a resinous fracture, and is easily separated from the ligneous portion; it is of a deep-brown, or reddish-brown colour, or reddish-gray or ash-coloured; hence we have the brown, gray, and red varieties; the powder is light, grayish-fawn, and has a nauseous odour; and the taste is bitter, acrid, and nauseous.

What is the active principle? — Emetia.

What is its character as an emetic, and its effects upon the system, and when used? — It is mild in its action; in large doses vomiting; in smaller, diaphoretic and expectorant; in smaller doses still, slightly stimulant to the stomach, and in very small doses, acts on the bowels. It is used as a gentle emetic, or in combination with more powerful ones, in hooping-cough, asthma, and pectoral affections generally; in combination with opium, as in Dover's powder, as an alterative.

What is the dose? — As an emetic, grs. xv.–xx.; as a nauseant, grs. ij.–iij.; as a diaphoretic, or expectorant, grs. ss.–ij.; as an alterative, grs. $\frac{1}{4}$ to $\frac{1}{2}$, two, three, or four times a day.

What is the dose of the wine of ipecacuanha?—For an adult, f℥i., for an infant, fʒi.

What other preparation has been used?—The syrup; dose, f℥ss., for an infant, fʒss.

Fig. 354.

LOBELIA.—What is the name of the plant from which this is derived?—Lobelia inflata, or Indian tobacco (Fig. 354), an indigenous, herbaceous plant.

When should it be collected?—In September.

What are the sensible properties of the powder?—It is of a greenish-yellow colour, irritating odour, and, when chewed, leaves an acrid taste on the tongue and palate.

What is its character as an emetic, and when used by the regular practitioners?—It is a violent emetic, and is used in asthma as such; it is much used by the Thompsonians.

To what does it impart its virtues?—To water and alcohol.

What are the effects of overdoses?—It produces extreme prostration, and death.

In what forms is it used, and what are the doses?—In powder, grs. xv.–xx.; tincture, fʒi.–fʒii., every two or three hours, till it acts.

MINERAL EMETICS.

TARTAR EMETIC. (*Vide supra.*)—What is its dose as an emetic?—Grs. ij.–iij., given in divided doses until it acts, or in combination with ipecacuanha, in the dose of tart. emet., gr. i., to ipecac., grs. x.

What is the dose of antimonial wine as an emetic?—For an adult, f℥i.–f℥ss.; for a child of one or two years, gtts. xx.–xl.

What is its character as an emetic, and when used?—It is forcible in its action, and is used in addition to evacuating the stomach in bilious remittent fevers, and at the onset of febrile diseases; in small

doses as an alterative in croup, where there is not much prostration; in nervous affections; for the reduction of dislocations, &c.

Sulphate of Zinc. (*Vide supra.*)—What is its dose as an emetic?—Ordinarily grs. x., but when the stomach is insensible, ʒss.

Sulphate of Copper. (*Vide supra.*)—What is the dose as an emetic?—In ordinary cases, grs. ij.–iij., but when the stomach is insensible, grs. v.–xv., but not repeated too speedily.

CATHARTICS.

What are these?—Medicines which produce evacuations from the bowels.

What are the influences of different cathartics upon different portions of the alimentary canal?—Some act upon the large intestines, and produce fæcal evacuations; others affect the peristaltic motions of the bowels; others cause watery discharges, and are called hydragogues, while calomel acts particularly upon the liver, and produces bilious evacuations.

When do cathartics act more favourably?—When given upon an empty stomach, and when exercising.

VEGETABLE CATHARTICS.

Manna.—What is this?—The concrete juice of ornus Europæa, and other species of ornus, growing in the south of Europe.

How is it obtained?—From the juice, which exudes either spontaneously or from incisions made in the bark; the purest is collected in dry, hot weather, and is the flake manna.

What are its peculiar features?—It is rough, white, light, porous, and brittle, and has a crystalline structure.

What are the characters of the common and fat manna?—The common is the next in quality; whitish or yellowish in colour; smaller than the flake, and mixed with a soft, viscid, uncrystallized mass; it is of a brown colour. The fat manna is a soft, viscous mass, yellowish-brown colour, and full of impurities.

What are the sensible properties of manna, and what are its relations to water and alcohol?—It has a slight, peculiar odour, sweet taste, which is very nauseous in the impure varieties; it is soluble in water and alcohol.

What is the name of the saccharine principle?—Mannite: obtained by boiling manna in alcohol, letting the solution cool, and redissolving the crystalline precipitate; it is white, inodorous, crystallizable; in semitransparent, needle-shaped crystals.

What are its characters as a cathartic, and when used?—It is a gentle laxative, but sometimes causes griping; it is used in constipation, particularly of pregnant women. It is used generally in combination with senna or rhubarb, or the neutral salts.

What is the dose of manna?—℥j.–℥ij.

Purging Cassia (*Cassia Fistula*).—What part of this is used?—The pulp of the fruit of the tree, growing in the East and West Indies.

What is the character of the fruit, and the sensible properties of the pulp? — The fruit is in pods, cylindrical, slightly curved, with a woody shell; dark-brown externally; internally it has longitudinal shining bands, with shining septa, covered with a black pulp, which is extracted by first bruising the pods, then boiling them in water, and then evaporating the solution; or, if the pods are fresh, taking the pulp out with a spatula; it has a slightly sickening odour, and sweet, mucilaginous taste.

What is its character as a cathartic, and in what cases is it used? —It is a mild laxative, and is used in cases of habitual constipation.

What is the dose? — As a laxative, ʒj.–ʒij.; as a purgative, ℥j.–℥ij. It is an ingredient in the confection of senna.

Castor Oil (*Oleum Ricini*).—From what is this derived?—From the seeds of the ricinus communis, a native of Africa, but cultivated in the United States and Europe.

What is the appearance of the seeds, &c.? —They are the size of a bean, oval, compressed, and obtuse at the extremities, very smooth and shining, ash-coloured, and marbled with reddish-brown spots. Internally they are highly oleaginous, of a black colour and sweetish taste, followed by a slight acrimony.

How is the oil extracted, and what are its sensible properties?—It is extracted in three ways: 1st, by decoction; 2d, by expression; 3d, by the aid of alcohol. The pure oil is a thick, viscid, colourless fluid, with little or no odour, mild and nauseous taste; as found in the shops it is slightly yellow.

Is it soluble in alcohol? — Yes.

What are the characters of oil as a cathartic, and in what cases is it applicable? — It is mild and certain in its operation, and beneficial in cases when you wish to produce very slight irritation of the intestinal canal with a free evacuation.

What is the dose of oil? — For an adult, f℥j.; for a child three or four months old, fʒj.

How is it best administered? — In milk, hot water, hot coffee, with the tincture of gentian, and in emulsion, and in the froth of beer, and juice of the sweet orange.

Are not olive oil, linseed oil, and melted butter cathartic?—Yes.

Rhubarb (*Rheum*).—What is this medicine? — The roots of the different species of rheum; herbaceous plants, growing in Central Asia, and cultivated in Europe.

What are the different varieties? — The Russian, Chinese, and European. The Russian is the best.

Describe the different varieties? — In the Russian, the pieces are irregular and angular; the hole in them only reaches to the centre, less compact and heavy, and cuts less easily than the Chinese. The

colour internally and externally is more lively than in other varieties, and the powder is of a buff colour; the odour and taste are aromatic. It stains the saliva yellow, and has a gritty feel under the teeth. The Chinese rhubarb is in cylindrical pieces; the hole passes all the way through them; the colour externally is dirty-yellow; it is heavier and more compact than the Russian, and, when broken, presents variegated surfaces; it has an aromatic and bitter, astringent taste, and stains the saliva yellow; the powder is browner than the Russian. The Chinese rhubarb is the variety most used. In the European rhubarb the pieces are longer than thick, sometimes flat or irregularly cylindrical; the texture is more ligneous, and the powder browner than in the other varieties. Its odour is nauseous, taste astringent, and it is scarcely gritty under the teeth.

What are the chemical constituents of rhubarb? — Rhubarberin, tannin, gum, starch, and oxalate of lime.

To what does it impart its virtues? — To boiling water and to alcohol.

What are its peculiarities as a cathartic, and in what cases is it applicable? — In its action it does not exhaust the energies of the patient, it has in addition an astringent effect, it acts also as a tonic and stomachic. It is used in constipation, debility of the stomach and bowels, in dyspepsia, in the early stages of diarrhœa, in cholera infantum, in typhoid complaints, &c. In case of its griping combine it with an aromatic.

Fig. 355.

What are the doses of it? —As a laxative, grs. v.–x., as a purgative, grs. xx.–xxx.

What are the officinal preparations?—The infusion, made with ʒj. to Oss. of boiling water, dose, f℥i.–f℥ij.; tincture, dose, fʒj.–f℥j.; the tr. rhei et aloe; tr. rhei et gentian; tr. rhei et senna, or Warner's gout cordial, doses, fʒj.–f℥j.; syrup of rhei, dose, fʒj.–fʒij.; the syr. rhei arom., dose, fʒj.–fʒij., and fluid extract, fʒj.

What effect has roasting on rhubarb? — It increases its astringent, and decreases its purgative effects.

Senna. — What is this medicine? (Fig. 355.) — The leaves of several species of

cassia, viz., C. acutifolia, C. ovata, C. elongata, small shrubs growing in Africa and Arabia.

What are the commercial varieties? — The Alexandria, Tripoli, and India.

What are the sensible properties of senna?—The odour is faint and sickly; the taste is slightly sweet, nauseous, and bitter; the colour is green. The colour of the powder is also green.

To what does it impart its virtues? — To water and alcohol.

What is the active principle? — Cathartin.

What is its character as a cathartic, and when is it used?—It is prompt and efficient, bringing away watery discharges, when it gripes it may be combined with aromatics and neutral salts. It is used in febrile complaints, and inflammatory diseases uncomplicated with inflammation of the alimentary canal.

In what form is it given, and what are the doses? — In powder, ʒj.; infusion, made with ℥j. of senna, ʒj. of sem. card., to Oj. of water; dose, f℥iv., every four or five hours, or f℥ij. more frequently repeated; fluid extract, fʒj.

What is the dose of the tr. senna et jalap, or Elixir salutis? — Fʒij.–f℥ss.

What is the composition and dose of the confection of senna? — The confection is composed of senna, coriander seed, liquorice root, figs, pulp of prunes, pulp of tamarinds, pulp of Cassia fistula, refined sugar, and water, dose, ʒj.–℥ss.

What is the name of the American senna? — Cassia marilandica; it possesses the qualities of senna, but in a less degree, and the dose should be ⅓ greater than that of senna.

Extract of Butternuts (*Extractum Juglandis*). — Whence is this obtained? — From the inner bark of the root of juglans cinerea.

How is the extract prepared, and what are its sensible properties? — By boiling the bark down, and evaporating the decoction to a proper consistence. It has a black colour, astringent, bitter taste, and sweet odour.

What are its characteristics as a cathartic, and when is it used? — It is mild, and applicable in the same cases as rhubarb.

What is the dose?—Grs. xx.–xxx., as a purgative; grs. x.–xij. as a laxative.

Aloes (*Aloe*). — What is this medicine? (Fig. 356.) — The inspissated juice of the leaves of the aloe spicata; A. socotrina, and A. vulgaris.

Where are these produced? —The A. spicata at the Cape of Good Hope; the A. socotrina at the Island of Socotora, and the A. vulgaris in the West Indies.

How is the aloe prepared for use?—The purest mode is by inspissating the juice placed in bladders or shallow vessels; the common kind is prepared by making a decoction and evaporating it.

What are the commercial varieties, and which is the best? — The commercial varieties are the Cape, Socotrine, and Hepatic. The Cape is the best.

Fig. 356.

Which plants yield these varieties?—The cape is derived from the aloe spicata. We are ignorant of the source of the socotrine, and also of the hepatic.

What are the characteristics and sensible properties of the cape and socotrine aloes? — The cape aloes is in masses of different sizes, of a shining surface, translucent at the edges; has a resinous fracture, a strong, disagreeable odour, and is of a dark olive colour; the powder is greenish-yellow. The socotrine aloes are in pieces of a yellowish or reddish-brown colour, becoming darker by exposure; the surface is glassy, fracture smooth and conchoidal, with sharp and semitransparent edges; the powder is bright, golden yellow. It has a peculiar, not unpleasant odour, and a bitter, disagreeable aromatic taste.

What are the chemical constituents of aloes? — A peculiar principle, soluble in water and alcohol; and a flea-coloured powder, soluble in alcohol, but scarcely soluble in boiling water.

What are its peculiar characters as a cathartic, and in what cases is it applicable? — It acts slowly, and chiefly upon the large intestines, producing feculent discharges; it is also more or less stimulating, when given in large doses; in small doses frequently repeated, it causes piles. It is applicable in cases of constipation, with debility of the stomach and alimentary canal; in dyspepsia, in combination with rhubarb and soap; it is used also as an injection in ascarides.

To what does aloes impart its virtues? — To cold and hot water, and to alcohol.

What is the dose of aloes? — As a laxative, grs. ij.–vj.; as a purgative, grs. x.–xv.

What are its officinal preparations? — Pills of aloes and assafœtida, dose, grs. x.–xx.; pills of aloes and myrrh, dose, grs. x.–xx.; compound rhubarb pills, dose, grs. x.–xx.; powder of aloes and canella, dose, grs. x.–xx.; tr. aloes, dose, f℥ss.–f℥iss.; tr. aloes et myrrh, dose, fʒj.–fʒij., &c.

Jalap (*Jalapa*). — What medicine is this? — The root of the ipomea jalapa (Fig. 357), a vine, native of Mexico.

What is the appearance of the root? — It is brought to market in

transverse and vertical slices, but more frequently in pear-shaped tubers of various sizes; the dried tubers are compact, firm, heavy, and wrinkled, and of a dark colour externally; when broken, they have a resinous fracture, and a grayish colour, diversified with a concentric arrangement of different matters, which are partly black and white; the dark-coloured portion is the more efficient. The powder is yellowish-gray.

Fig. 357.

What are its sensible properties, and to what does it yield its virtues?—The odour is sweet and nauseous; the taste is sweetish, acrid; the colour reddish. It imparts its virtues partially to water and alcohol, and entirely to diluted alcohol.

What is its chemical nature?—A resin and gummy extract.

Which is the more efficient, the resinous or the gummy portion?—The resinous.

What is the dose of powdered jalap?—Grs. xv.–xxx.; and in combination, jalap, grs. x., and potas. bitart. ʒj.–ʒij.; or calomel and jalap, āā. grs. x. The dose of the resin is grs. viii.–x.

What are its characters as a cathartic, and when applicable?—It is active, producing watery stools, and is used in cases of dropsy, in fevers, and when you wish to act upon the whole alimentary canal; it is usually combined with rhubarb calomel, cremor tartar, &c.

How is the extract prepared?—By taking the powdered jalap, alcohol and water, macerating the jalap in alcohol, pouring off the tincture, adding water to the residue, and boiling down, and straining the decoction and mixture separately; distil the former and evaporate the latter; mix them together, and again evaporate.

What is the dose?—Grs. x.–xx.

Scammony (*Scammonium*).—From what is this medicine made?—The inspissated juice of the root of the convolvulus scammonia, which grows in Syria and Asia Minor.

How is this prepared for use?—The earth is cleared from the root, the top cut off; the juice which exudes is collected in shells, and allowed to concrete.

What are the commercial varieties, and describe them, &c.?—The

Aleppo and Smyrna. The Aleppo is the best, and comes in saucer-shaped masses, which are heavy and of a porous structure, or sometimes compact; has a faintly shining fracture; externally it is olive-gray, internally lighter, and becomes darker by exposure. It has the odour of old cheese from ewe's milk; the taste is bitter and slightly acrid; the powder is light-coloured. The Smyrna comes in flat cakes; darker, more compact, heavier, and harder than the preceding; it has a dull, earthy fracture, and a bitter, acrid taste, and is not as good as the Aleppo.

What are its relations to water and alcohol? — It is dissolved by water and alcohol, and entirely by diluted alcohol.

What is it chemically? — A gum resin.

What are its characters as a cathartic, and when is it used? — It is energetic, apt to occasion griping; used chiefly in combination, as in the ext. colocynth. comp. in the same cases where jalap is beneficial.

How is it used, and in what preparation? — Generally in combination, and particularly in the comp. ex. colocynth, grs. v.–x.

Black Hellebore (*Helleborus*).—What part of the plant Helleborus niger is used? — The fibrils of the root. The plant grows in the south-east of Europe.

What are their properties? — They are about the size of a straw, from four inches to a foot in length; smooth and brittle; and externally black or deep brown; internally yellowish-white. They have little smell, a bitter, nauseous, acrid taste, and lose their virtues by keeping and exposure; the powder is yellowish-brown.

To what do they impart their virtues?—To water and alcohol; long boiling impairs their virtues.

What other name has it?—Melampodium.

What is its character as a cathartic, and when is it used?—It is a drastic hydragogue cathartic, and possessed of emmenagogue properties; in over-doses it produces gastro-intestinal irritation, with vomiting, hypercatharsis, vertigo, cramp, and death. It is used in mania, amenorrhœa, dropsy, epilepsy, and in uterine complaints.

How and in what quantity is this given?—In powder, grs. x.–xx.; in decoction, made ʒij. to Oj. of water, dose, f℥j.; tincture, fʒi.; extract, grs. xij.–xv.

Colocynth (*Colocynthis*). — What is this medicine? — The fruit of the Cucumis or Citrullus colocynthis, a plant resembling the garden cucumber, growing in Turkey, Africa, and Asia.

What is the appearance and sensible properties of the fruit? (Fig. 358.) — It is globular, the size of a small orange, yellow and smooth when ripe, and containing a white, spongy, medullary matter, enclosing numerous seeds; the fruit is picked in the autumn, and dried quickly; it is kept in the shops in white balls, light and spongy, and abounding in seeds; the pulp is the only part used in medicine. It has a feeble odour, and a nauseous and intensely bitter taste.

What is its active principle, and to what does it impart its

virtues? — The active principle is colocynthin. It imparts its virtues to water and alcohol.

Fig. 358.

What is its character as a cathartic, and when used?—It is a powerful hydragogue drastic cathartic, in over-doses producing bloody stools, and inflammation of the intestinal canal. It is used by the Germans in cases of dropsy, and in diseases arising from disordered state of the brain; it is chiefly used by us in combination in disorders of the chylopoietic viscera.

What is its dose?—Grs. v.–x.

What is the composition and dose of the compound extract?—It is composed of pulp of colocynth, pulv. aloe, pulv. scammony, pulv. cardamom., castile soap, and alcohol. The dose is grs. x.–xv.

GAMBOGE (*Gambogia*). — What is this medicine?—The inspissated juice, supposed to be derived from the Stalagmitis cambogioides, or the Garcinia cambogia, natives of Asia.

What is the appearance and sensible properties of the pieces? — They are in cylinders, sometimes hollow and flat, and agglutinated together. The surface is striated, of a dull orange colour, and breaks with a shining, smooth, conchoidal fracture, and translucent at the edges. The powder is bright yellow. It has no smell, very little taste at first, but afterwards acrimony is perceptible.

What is it? — A gum resin.

What are its relations to water and alcohol?—It is dissolved partly by water and partly by alcohol.

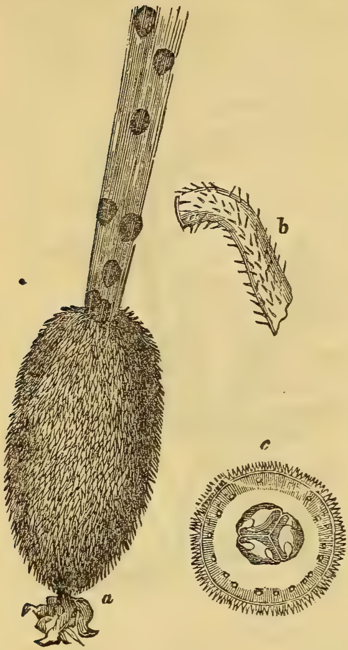
What is its character as a cathartic, and in what cases is it used? — It is a powerful drastic hydragogue, in large doses producing vomiting, it is used in dropsies in combination with other cathartics, as cremor tartar; in worms, &c.

What is the dose? — Grs. iij.–vj., in pill or emulsion.

What is the composition of the compound cathartic pill?—Comp. ext. of colocynth, ex. jalap, calomel, and pulv. gamboge; dose, 3 pills.

ELATERIUM.—From what is this derived?—From the Momordica elaterium, or squirting cucumber; a vine similar to the common cu-

Fig. 359.



cumber growing in Great Britain, but a native of Europe.

What is the character of the fruit, and how is the elaterium obtained? (Fig. 359.)—The fruit is oval, an inch and a half long, and an inch thick; of a greenish or grayish colour, covered with prickles. The elaterium is the substance spontaneously deposited by the juice of the fruit, when separated and allowed to stand.

Which is the best? — Clutterbuck's.

What are the characteristics of elaterium?—It is in thin, flat cakes or fragments; of a greenish-gray colour; bitter, acrid taste; light, pulverulent, and inflammable, with little smell.

What is the active principle? — Elaterin.

What is its character as a cathartic? — It is a powerful hydragogue, in over-doses producing inflammation and sometimes death. It is highly beneficial in dropsy.

What is the dose? — One-eighth of a grain of the best, and one-half a grain of the common kind, every half hour till it operates; and of elaterin, from one-sixteenth to one-twelfth of a grain.

Croton Oil (*Oleum Tiglii*). — Of what is this a product? — Of the seeds of the croton tiglium, a small shrub, native of the East Indies.

Describe the seeds. — They are larger than a grain of coffee; oblong, and rounded at the extremities; the shell is covered with a yellowish-brown epidermis, beneath which it is black and smooth; the kernel is yellowish-brown and abounds in oil.

How is the oil obtained from the seeds, and how do we find it in the shops?—The oil is obtained by roasting and pressing the seeds; and, as found in the shops, is of an orange or yellowish colour; the odour is faint, and it has a peculiar acrid taste.

What are its chemical constituents, and in what is it soluble? —It is partly soluble in alcohol, insoluble in water, and contains an acrid and oleaginous principle.

What is its character as a cathartic, and when is it applicable? —

It is a powerful hydragogue, in over-doses producing griping, inflammation, and sometimes death. It is employed in cases of constipation.

What is the dose? — Gtts. i–ij., in pill of crumb-bread.

What are its effects when externally applied? — It pustulates.

MINERAL CATHARTICS.

SULPHUR. — (See *Chemistry*.)

How is it prepared for medical uses? — By resublimation and washing.

What names have been given to it when prepared? — Flowers of sulphur, sublimed sulphur, and washed sulphur.

What are its sensible properties? — It is of a yellow colour, slight taste, and peculiar smell.

In what is it soluble?—In the volatile and fixed oils, and insoluble in water and alcohol.

What are its medicinal properties, and in what cases is it applicable? — It is a laxative diaphoretic, with a peculiar tendency to the skin, it is also alterative in its action. It is applicable in constipation with piles, in dyspepsia, in chronic rheumatism, and gout, and in cutaneous affections.

What is the dose of it? — ℥i.–℥ij., as a laxative; or in smaller quantities, as an alterative.

How is it used externally? — In the form of an ointment, made with sulphur, ℔i., adeps, ℔iv.; also in vapour.

PRECIPITATED SULPHUR (*Sulphur Præcipitatum*); LAC SULPHURIS, OR MILK OF SULPHUR. — How is this prepared? — By boiling sulphur and lime together in water, filtering the solution, and adding sufficient muriatic acid to precipitate the sulphur and then washing it.

What is the dose? — The same as sulphur.

CARBONATE OF MAGNESIA (*Magnesiæ Carbonas*). — How is this obtained?—By decomposing sulphate of magnesia with carbonate of soda or potassa.

How is it found in the shops, and what are its properties? — It is found in prisms and cubes; it is light, without smell, and with little taste, of a white colour, and smooth to the touch.

What are its peculiarities as a cathartic? — It is a gentle laxative, and highly antacid, and hence is applicable to cases of great acidity of the stomach.

In what is it soluble? — It is slightly soluble in water, more so in cold than in hot, and entirely soluble in carbonic acid water.

With what is it adulterated?—With lime; which may be detected by diluting the carbonate in solution with sulphuric acid, and then adding oxalate of ammonia, when oxalate of lime is precipitated.

What is it chemically? — A subcarbonate.
What is the dose? — From ʒi.–ʒij.

Magnesia. — What names are sometimes given to this?—Calcined magnesia and magnesia usta.
How is this prepared? — By calcining the carbonate and then adding muriatic acid, by way of test, until no effervescence takes place.
What are its sensible properties?—It is in a white powder, with a peculiar taste, without smell, and almost insoluble in water.
What kind of a cathartic is it, and when applicable? — It is mild and gentle in its action, and antacid; when too long-continued it may collect in the bowels; this may be remedied, however, by administering an acid. It is used in dyspepsia, sick stomach, headach, gout, constipation, &c.
What is this chemically? — A metallic oxide; of magnesia, one equivalent, and oxygen, one equivalent.
What is peculiar in Henry's magnesia? — It is much heavier than the ordinary variety, smoother, and mixes with water more readily.
What is the dose of magnesia?—For an adult, ʒi.; for a child two years old, from grs. x.–xx.
How is it best administered?—By throwing the magnesia on water or milk, and stirring it.
What are the peculiarities of action in the saline cathartics? — They produce watery evacuations, and are sedative to the circulation generally; hence they are applicable in inflammatory and febrile diseases, and one may conveniently be substituted for the other.

Sulphate of Soda (*Sodæ Sulphas*).—What is the common name for this?—Glauber's salt.
Whence is it derived? — It sometimes is found native, and is also the salt remaining after muriatic acid is obtained. (See *Chemistry.*)
What is the appearance, sensible properties, &c., of the crystals? —They are four and six-sided prisms, striated; they effloresce on exposure; they have a nauseous, saline taste; when heated, the crystals undergo watery fusion.
What is its solubility? — It has different degrees of solubility according to the temperature; the temperature at which it is most soluble is 91° Fahrenheit.
What is the dose? — Of the crystallized salt, ℥j.–℥ij.; of the effloresced, one-half the quantity.
How is it administered?—In combination with lemon-juice or tartaric acid.

Sulphate of Magnesia (*Magnesiæ Sulphas*).—By what name is this usually known? — Epsom salts.
What are its sources and mode of preparation, &c.?—It is one of the constituents of sea-water; it is also found in various springs, and

it may be formed by the action of sulphuric acid upon magnesite or other magnesian rocks.

How is it found in the shops?—In needle-shaped crystals.

Does it effloresce on exposure? — Yes, slowly.

Is it soluble in water? — Yes, in equal weights of cold water, and in three-fourths its weight of boiling water.

What is its taste? — Saline and bitter.

What is its dose? — ℥i.

Sulphate of Potassa (*Potassæ Sulphas*). — What was this formerly called? — Vitriolated tartar.

How is it obtained?—As the residue left in the retort after obtaining nitric acid. (See *Chemistry*.)

Describe the crystals. — They are small, six-sided prisms, with a rough base, and very hard.

For what are they used? — In the preparation of Dover's powder.

In what are they soluble, and what effect has heat upon them? — They are soluble in nine parts of cold and four of warm water, and they decrepitate by the action of heat.

What is the taste? — Nauseous and bitter.

What is the dose? — ℥ss.–ʒvj.

Bitartrate of Potassa (*Potassæ Bitartras*). — What are the common names for this? — Cremor tartar, and crystals of tartar.

What is the source of it, and how is it prepared? — It is obtained from the juice of the grape; the crude tartar sticks to the inside of wine-casks, from which it is taken, purified by dissolving and redissolving, and crystallizing. It is imported in crystals.

What is their appearance, and how are they kept in the shops? — The crystals are white, in crusts and masses, agglutinated together; they are kept in the shops in a white powder.

What is their taste, solubility, &c.? — The taste is sour; they are soluble in sixty parts of warm water, and insoluble in alcohol; time and exposure decomposes the solution.

What are its peculiarities as a cathartic, and when is it used? — It is hydragogue and refrigerant, with a peculiar tendency to the kidneys. It is beneficial in dropsy, inflammation of serous membranes, in diseases of the hip and knee-joints, and especially of a scrofulous nature, when it is combined with jalap.

How is it administered, and what is the dose?—By dissolving it in warm water, allowing it to cool, then sweeten it; dose, f℥ss.–f℥i

Tartrate of Potassa (*Potassæ Tartras*). — What was this formerly called? — Soluble tartar.

How is it prepared? — By taking carbonate of potassa, bitartrate of potassa, and boiling water; dissolving the carbonate of potassa in the water, and adding the bitartrate until effervescence ceases.

Has it any water of crystallization? — No.

What is its form, colour, &c.?—It is in white crystals, with irregular summits, slightly deliquescent; the taste is cooling and bitterish; and swells up, becomes blackened, and decomposed by heat.

What effect have the acids and acidulous salts upon it?—They decompose it.

What is the dose?—℥ss.–℥i.

TARTRATE OF POTASSA AND SODA (*Sodæ et Potassæ Tartras*).—What is the common name for this?—Rochelle salts.

How is it prepared?—By dissolving carbonate of soda in boiling water, and adding, gradually, the bitartrate of potassa, filtering, and crystallizing, &c.

What is this chemically?—A double salt of the tartrate of potassa and soda.

What is its appearance, properties, &c.?—The crystals are sometimes very large, right prisms, but, as ordinarily found, are half prisms with unequal sides; they effloresce on exposure; their taste is saline and bitter; heat decomposes them. They are soluble in two and a half times their weight of cold, and much less of boiling water.

What is its character as a cathartic?—It is mild and gentle, and has the least unpleasant taste of any of this class.

What is the dose?—℥i.–℥iss.

What is the composition of Seidlitz powders?—Sodæ et potas. tart., ʒij., sodæ bicarb., ℈ij., in a white paper; and acid tartaric, grs. xxv., in a blue paper; each is to be dissolved separately in water, and taken in a state of effervescence when mixed together.

PHOSPHATE OF SODA (*Sodæ Phosphas*).—How is this prepared? By calcining bones, adding sulphuric acid and carbonate of soda, and macerating, washing, and crystallizing, &c.

How is it kept in the shops, and what is its taste and solubility, &c.?—It is kept in large, white, efflorescent crystals; they have a pure saline taste, and are soluble in four times their weight of cold, and twice their weight of boiling water.

What is the dose?—℥i.–℥ij.

CALOMEL.—What is the officinal name for this?—Mild chloride of mercury, hydrargyri chloridum mite. (For preparation, &c., see *Chemistry*.)

What impurity sometimes exists in this, and how may it be freed from it?—The bichloride, or corrosive sublimate, which may be freed from it by washing it with boiling water, and adding aqua ammonia until no precipitate forms.

What are its properties?—It is a white, tasteless, inodorous, insoluble substance, unalterable in the air, but blackened by exposure to light; when in mass it is generally in crystalline cakes, the interior of which are horny and elastic in texture; sp. gr. 7·2.

What are its incompatibles?—The alkalies and alkaline earths,

the alkaline carbonates, soaps, hydro-sulphates, and, according to some, iron, lead, and copper.

What is the peculiarity of Howard's calomel?—It is prepared by causing the calomel in vapour to come in contact with steam in the subliming vessel, whereby it is converted into an impalpable powder, and perfectly washed from corrosive sublimate.

What is the character of calomel as a mercurial?—It is the best.

What are its properties as a cathartic, and in what cases is it applicable?—In doses from v. to xx. grs. it purges briskly, causing bilious stools, sometimes accompanied with pain and griping; in small doses it is alterative, and, if pushed too far, may produce ptyalism. It is highly beneficial in the commencement of autumnal fevers, and when there may be congestion of the liver; also in constipation, jaundice, nephritis, gastritis, and all the phlegmasiæ; it is used largely also in diseases of children.

What is the dose as a purgative?—Grs. v.–xx.; and if it does not operate freely, follow by castor oil or salts.

With what is it often used in combination?—With jalap, rhubarb, scammony, &c. The dose of calomel and jalap, āā. grs. x.

What is the dose of calomel for a child?—Grs. iv.

What is the dose of calomel as an alterative?—Gr. ss. to ij. every two or three hours.

ENEMATA.

What are enemata?—Medicines in a fluid state injected into the rectum to facilitate the action of other medicines, or to operate upon the bowels when the stomach is too irritated to allow of their being introduced into the system through it.

What is the composition of the common enemata?—Salt, molasses, lard, or olive oil, āā. f℥ss., and warm water, Oj.; and we may add ol. ricini, f℥ij. The oil of turpentine, assafœtida, &c., have been used as ingredients in injections.

DIURETICS.

What are diuretics?—Medicines which increase the secretion of urine.

How would you favour the action of diuretics?—By the administration of cold drinks, keeping the body cool, and resort to such means as shall prevent perspiration.

In what complaints are diuretics beneficial?—In dropsical complaints, inflammation and irritation of the urinary organs, in nephritis, and in febrile complaints.

Foxglove (*Digitalis*). (*Vide supra*).—Is not this a powerful diuretic?—Yes.

What is the dose and preparation. (See *Nervous Sedatives.*)

What is there peculiar in its action, and in what cases is it appli-

cable? — It may be retained for some days in the system without apparent action, and then act vigorously. It is applicable in cases of albumen and coagulable matter in the urine. It is one of the most efficient diuretics.

SQUILL (*Scilla*). — What part of this is officinal? — The bulb of the scilla maritima, an herbaceous plant, native of the countries bordering upon the Mediterranean Sea.

What are the varieties and characters of the bulbs, &c.? — There are two varieties, the white and red; the bulb is pear-shaped, of various sizes, consisting of scales, attenuated at the edges, closely applied to each other, and invested with a membranous coat. In the white variety the whole bulb is white. In the red variety the epidermis is red.

How are they prepared for market, and how is it found in the shops, &c.? — They are prepared for market by slicing them transversely, and drying; the outer and central portions are removed. As found in the shops they are in irregular, oblong pieces, more or less contorted, and of a dull yellowish-white colour, with a reddish tint, brittle, and pulverizable when perfectly dry. They have a feeble odour, and an acrid, nauseous taste.

To what do they impart their virtues, and what is their active principle? — They impart their virtues to water and alcohol. The active principle is scillitin.

Fig. 360.

What is its character as a diuretic, and how is it prescribed?—It is mild in its character, and is generally prescribed in dropsical diseases, in combination with calomel.

What are the effects of overdoses?—Hypercatharsis, strangury, bloody urine, inflammation of the stomach and bowels, &c.

What is the dose? — Grs. i.–iij, two or three times a day, gradually increased.

COLCHICUM ROOT (*Colchici Radix*); COLCHICUM SEED (*Colchici Semen*). — What is this medicine? —The root and seeds of the colchicum autumale, or meadow saffron. (Fig. 360.)

Describe this plant, bulb, &c. — It is a perennial, bulbous plant, a native of the temperate parts of Europe, but is cultivated in the United States; the bulb, which re-

sembles the tulip in shape, has a brown, membranous coat; internally, solid and fleshy; and should be collected in July and August.

How is it prepared for market, and what are its properties?—The bulb is cut into thin, transverse slices as soon as dug up, and these are spread out and dried by a moderate heat; the slices are flat and white on both sides, the odour of the fresh is disagreeable, and the taste hot and acrid.

To what does the root impart its virtues, and in what do the virtues consist?—It imparts its virtues to water, alcohol, and vinegar; the active principle is colchicum or colchici. Time injures its preparations.

When should the seeds be collected, and what are their peculiarities?—They should be collected in July and August; they are small, spherical, and brown, and their virtues exist in the outer coating.

What are its effects upon the system?—It acts upon the nervous system generally, and on all the secretions; in large doses it purges, and in still larger vomits. It has been used in gout, rheumatism, neuralgia, &c.

What is the dose of colchicum?—Of the root or seeds in substance, grs. ij.–v., but they are not often given in this way; more frequently in the wine of colchicum root, vinum colchici radicis.

How is this made?—In the proportion of one pound of the bulb to one pint of wine.

What is the dose?—In acute cases, gtts. x.–xx., every three or four hours; in chronic cases, gtts. x.–xx., three times a day.

WINE OF COLCHICUM SEEDS (*Vinum Colchici Seminis*).—In what proportion is this made, and what is the dose?—It is made, with ℥j. to Oj. of wine. The dose is from fℨss.–fℨij.

Fig. 361.

WHITE HELLEBORE (*Veratrum Album*); AMERICAN HELLEBORE (*Veratrum Viride*).—What parts of these are used in medicine? (Fig. 361.)—The roots of the veratrum album, and veratrum viride, herbaceous plants; the former a native of Europe, the latter a native of the United States.

Describe the roots and their sensible properties?—They are fleshy, fusiform, yellowish-white externally, and pale, yellowish-gray internally; they have a disagreeable odour, which is lost by drying; the taste is first sweetish, then bitterish, acrid, burning, and durable.

What are its effects upon the system, and when is it administered?

—It is a violent emetic and cathartic, and when used incautiously it is dangerous. It is beneficial in gout, rheumatism, neuralgia, &c.

Fig. 362.

What is the active principle?—Veratria.

Are not these roots dangerous medicines?—Yes.

What is the dose of the powder?—Grs. ij.–viij.

VERATRIA. — Whence is this obtained, and what are its sensible properties? — It is obtained from the cavadilla, the seeds of a Mexican plant. It is a white, pulverulent, uncrystallizable substance, inodorous, very acrid, and fusible by heat.

In what is it soluble? — It is scarcely soluble in cold water, soluble in one thousand parts of boiling water, and also in alcohol.

In what way is it generally used? — In ointment, made with grs. xl., to adeps, ℥j.

INDIAN HEMP (*Apocynum Cannabinum*). — What part of this plant is used? Fig. 362.) — The root.

Where does this plant grow, and what are the characters of the root? — The plant grows in the United States; the root is horizontal, one-third of an inch thick, of a yellowish-brown colour when fresh, but dark-chestnut when old; it has a strong odour, with a nauseous, acrid, and permanently bitter taste; the fresh root when bruised emits a milky juice.

To what does it impart its virtues? — To water and alcohol.

What are its effects upon the system, and in what cases is it used? — It is a powerful emetic, cathartic, and diuretic; it is employed in cases of dropsy.

In what form is it used, and what is the dose? — In decoction, by boiling ℥ss. in three half-pints of water to a pint; and the dose is from f℥i.–f℥ij., two or three times a day.

Dandelion (*Taraxacum*). — What is this medicine? (Fig. 363.) —The root of the Leontodon taraxacum, an herbaceous plant, growing in all parts of the world.

Fig. 363.

Describe the root and its sensible properties, &c. — The root is several inches in length, thin, round, and tapering, of a brown colour externally, without smell, and has a sweetish, mucilaginous, bitter taste, and imparts its virtues to water and alcohol; time injures it.

In what cases is it used, and what are its effects upon the system? It is used in chronic hepatic affections, and especially those complicated with dropsy. It is tonic and diuretic.

How is the decoction made, and what is the dose?—By boiling ℥j. of the dried, or ℥ij. of the fresh root, in Oj. of water, down to a half pint; the dose is f℥ij., two or three times a day.

When should the extract be prepared, and what is the dose?—The extract should be made in August; the dose, grs. xx.–xxx.

Juniper Berries (*Juniperus*). — Of what are these the fruit? — The Juniperus communis, an evergreen shrub, native of Europe, but naturalized in the United States.

What is the appearance and sensible qualities of the berries? — They are globular, more or less striated; the size of a pea; they are covered with a glaucous bloom; beneath which they are shining and blackish purple, and contain a brownish-yellow pulp, and three angular seeds. They have an agreeable aromatic odour, and a sweet, warm, bitterish, terebinthinate taste.

What is their active principle, and to what do they impart their virtues?—Their active principle is the volatile oil of Juniper berries; they impart their virtues to water and alcohol.

What is its character as a diuretic, and when is it used? — It is a mild, stimulating diuretic, useful in cases of dropsy, in too large

doses it is inflammatory to the urinary passages, it is generally given in combination.

How is the oil prepared, and what is its colour? — The oil is prepared by distillation, and is at first green and afterwards yellow.

How is the infusion made, and its dose? — ℥j. of the bruised berries are put to Oj. of water, and the dose is a pint daily.

What is the dose of the oil? — Gtts. v.–xv.

Wild Carrot (*Carota*).—What part of this is used?—The seeds of the Daucus carota, an indigenous herb.

What is the character and sensible properties of the seeds?—They are very light, of a brownish colour, oval-shaped, flat on one side, and convex on the other; they have an aromatic odour, and a warm, pungent, bitterish taste.

What is the active ingredient?—A peculiar volatile oil.

What is its character as a diuretic, and in what cases has it been used? — It is a moderately stimulating one, and has been used in nephritic affections, in dropsies, &c.

How is it used, and what is the dose? — In infusion, made with ℥ss. of the seeds to Oj. of water, and the whole taken daily.

Has not the garden carrot been used externally for a poultice when scraped? — Yes.

Is not the root of the common parsely a very good diuretic?—Yes.

Turpentine (*Terebinthina*).—What is this? — The juice of different species of the genera pinus, abies, and larix.

Of what does it consist? — Of a resin and a peculiar volatile oil, called oil of turpentine.

What are the varieties of turpentine used in the United States?—The common white turpentine, and the Canada turpentine.

From what tree is the white turpentine derived?—From the pinus palustris of the south.

When is it collected, how is it brought to market, and what are its properties as found in the shops? — It is collected in the winter, brought to market in casks, and, as found in the shops, has a peculiar aromatic odour, warm, pungent, bitterish taste, and is of a white colour tinged with yellow, slightly translucent, and of a consistence varying with the temperature at different seasons of the year.

What are the names for the Canada turpentine? — Terebinthinæ Canadensis, Canada balsam, and balsam of fir.

Of what is this the product? — The abies balsamifera, growing in the Northern States and Canada.

Where is the turpentine found? — In the vesicles upon the trunk and branches, which, upon being broken, exude the turpentine.

Describe it, and its sensible properties, &c. — When fresh, it is colourless, or slightly yellowish and transparent, of the consistence of honey, tenacious, of a strong, agreeable odour, and a bitter, somewhat

acrid taste; it becomes more yellow and thicker by exposure, and then assumes a solid consistence.

What are the effects of heat upon the turpentines? — They are rendered more liquid by heat, and take fire at a high temperature.

What are their relations to water and alcohol? — Water extracts only a small quantity of the volatile oil; they are soluble in alcohol and ether, and readily unite with the fixed oils.

What is their chemical composition? — A resin and volatile oil; their virtues reside in the volatile oil.

What are their effects upon the system, and in what cases are they to be prescribed? — They are stimulant, diuretic, and anthelmintic; in large doses, laxative, and may produce irritation in the urinary passages. They are prescribed in gleet, chronic diseases of the urinary organs, in inflammation of the bowels, in rheumatism, &c.

What is the dose of the oil of turpentine, as a diuretic? — Gtts. x.–xx., two or three times a day.

What is the dose of turpentine?—Grs. x.–ʒj., in pill or emulsion; or it is used externally as a liniment.

TAR (*Pix Liquida*).— From what is this obtained? — From the pinus palustris, or other species of pinus of the Southern States.

What are its properties? — It has a peculiar empyreumatic odour, bitter, resinous, acrid taste, an almost black colour, and tenacious consistence.

What is it chemically? — Resin, united with acetic acid and empyreumatic oil, coloured by charcoal.

What are its relations to water? — It yields a small proportion of its constituents to water.

For what has tar water been used? — Phthisis pulmonalis, chronic catarrh, and in general bronchial affections.

For what has the tar ointment been used? — In tinea capitis, or scald head, indolent ulcers, &c.

What is the dose of tar and tar water? — Of tar, fʒi.–fʒss.; of tar water, a pint or two in the day.

How else has tar been used? — In vapour and ointment.

What is the residue after the evaporation of the volatile oil of tar? — Pitch.

CREASOTE (*Creasotum*).—Whence is this obtained?—From tar or crude pyroligneous acid. (See *Dispensatory*.)

What are its properties? — When pure, it is a colourless, oleaginous liquid, greasy to the touch, volatilized by heat, and having a caustic, burning taste, and a penetrating, disagreeable odour, like smoked meat; sp. gr. 1·037.

What are its relations to water and alcohol, &c.? — It forms two combinations with water; the one, of one part of creasote to eighty parts of water; and the other of one part water to ten of creasote; and unites, in all proportions, with alcohol, ether, and naphtha.

What are some of its peculiar properties?—It prevents putrefaction and coagulates albumen.

In what cases has it been used externally and internally?—Externally in eruptions, wounds, ulcers, and as an injection and gargle. Internally in diabetes, epilepsy, hysteria, neuralgia, chronic catarrh, pulmonary consumption, &c.

How is it used externally and internally?—Externally, in watery solution and in ointment; and internally, in the dose of gtts. i.–ij.; in emulsion, &c.

Resin (*Resina*).—What is this?—The residue after the distillation of the oil from turpentine.

What are the varieties?—Yellow and white; the yellow is the simple resin, the white is resin shaken in water while in a state of fusion.

What are the properties of resin?—It is a smooth, brittle solid, of a yellowish colour, and semitransparent; when pure, it is inodorous and insipid, fusible by heat, decomposed by a high temperature, and takes fire in the open air.

What is its solubility?—It is soluble in water, as also in ether and the essential oils, and in alcohol.

For what is resin used?—As an ingredient in ointments and plasters.

Of what particular ointment is it the basis?—Of the resin cerate (ceratum resinæ), or basilicon ointment.

Copaiba.—What is this commonly called?—Balsam of copaiva.

Whence is it derived?—From the different species of the copaifera, growing in Brazil and Guiana.

How is it procured from the tree, what is its appearance when first obtained, and how is it kept in the shops?—The juice is procured by making incisions into the stems and branches of the tree. As first obtained it is clear, colourless, and thin, but soon acquires a thicker consistence and a yellowish tinge; and, as found in the shops, it is clear and transparent, of the consistence of olive-oil, of a pale yellow colour, a peculiar, not unpleasant odour, and a bitterish, hot, nauseous taste.

What are its relations to water and alcohol?—It is insoluble in water, but entirely soluble in absolute alcohol.

What are its chief ingredients?—A volatile oil and resin; the former is probably the active principle.

How is the oil obtained, and what are its properties?—It is obtained by distillation with water; at first it is colourless, but afterwards it has a fine green hue; it has the odour and taste of copaiba; when exposed, it becomes darker and thicker, and of greater density.

What effect has a mixture with magnesia upon it?—It becomes hard, and easily formed into pills, which should consist of one-sixteenth of magnesia.

What are its effects upon the system, and in what cases has it been used? — It is a stimulating diuretic, and has been used in diseases of the kidneys, in gonorrhœa before the inflammatory stage, in chronic cystitis, in chronic bronchitis, &c.

What is the dose? — Gtts. x.–xxx., three times a day, in pill, capsule, or emulsion; and of the volatile oil, gtts. v.–xv.

Spanish Flies (*Cantharis*). — (See *Epispastics.*)

What are their effects upon the system, and when applicable? — They are powerfully stimulant, with a tendency to the urinary organs, &c.; in over-doses they produce strangury, inflammation of the neck of the bladder, bloody urine, nephritis, &c. They have been used in chronic inflammation, and in debility of the genito-urinary organs, in gleet, gonorrhœa, and in incontinence of urine, &c.

What is the dose as a diuretic? — Gr. i., two or three times a day; or of the tincture, gtts. x., frequently repeated.

Carbonates of Potassa. — Which of these are used? — The carbonate and bicarbonate.

How is the carbonate procured? — From the impure carbonate, by solution, recrystallization, &c.; it is a deliquescent salt.

What are the impurities? — Foreign salts and earthy matters.

How is the purer variety, or salt of tartar, prepared?—By rubbing potas. bitart. and potas. nitras. separately in powder, throwing them in a brass kettle heated to redness, and then preparing it as you would do the carbonate.

How is it found in the shops, and what are its properties? — It is in a coarse, white, granular powder, with a nauseous, alkaline taste, and an alkaline reaction; it is soluble in water, but insoluble in alcohol.

In what cases is it applicable?—As an antacid, in cases where there is too great a preponderance of acid in the urine.

What is its dose?— Grs. x.–xxx., three or four times a day.

How is the bicarbonate prepared?—By saturating a solution of the carbonate with carbonic acid gas; then filtering and evaporating the filtered liquor, that crystals may form, taking care that the heat does not exceed 120° Fahrenheit; then dry the crystals.

What are its properties? — It is in the form of white, inodorous crystals, permanent in the air, with a slight alkaline taste, dissolving in four times its weight of cold water, and in five-sixths of boiling water; it is sparingly soluble in alcohol; when too great heat is used, either in the form of boiling water, or otherwise, it is decomposed.

What is its dose? — ʒss.–ʒi.

Acetate of Potassa (*Potassæ Acetas*).—What was this formerly called? — Sal diureticus.

How is it prepared? — By saturating a solution of the carbonate of potassa with acetic acid; heating the mixture, and clearing the

liquid with animal charcoal; and then evaporating it to dryness, until a pellicle is formed, which must be removed; and as soon as another pellicle is formed, it should be removed; and these pellicles placed in a well-stopped bottle.

What are its properties?—It is a white, deliquescent salt, with a pungent, saline taste; soluble in half its weight of water, and twice its weight of alcohol.

What is its dose?—℈i.–ʒi., every two or three hours, in solution.

Bitartrate of Potassa. (*Vide supra.*)

What is its dose as a diuretic?—℥i.–℥ij., given daily in divided doses.

Nitrate of Potassa. (*Vide supra.*)

In what cases is it applicable?—In dropsy, with high inflammatory action.

What is its dose as a diuretic?—Grs. x.–xx., frequently repeated.

Spirit of Nitric Ether (*Spiritus Ætheris Nitrici*).—What is the common name for this?—Sweet spirits of nitre.

How is it prepared?—By taking nitrate of potassa, sulphuric acid, alcohol, and diluted alcohol and carbonate of potassa; mix the nitrate of potassa and the acid in a glass retort, pour in the alcohol gradually, and digest the mixture with a gentle heat, then raise the heat and distil. To the distilled liquor add the diluted alcohol and carbonate of potassa, and again distil.

What are its properties?—It is a colourless liquid, of a grateful etherial odour; when fresh, it has a sweet, and when old, a sour taste; it is very volatile and inflammable.

In what is it soluble, &c.?—It is soluble in water and alcohol; it has the same specific gravity as alcohol; and is often diluted with alcohol.

What is its character as a diuretic?—It is very mild, and is often used in combination with digitalis, squill, &c., in cases of dropsy, &c.

What is its dose?—Fʒss.–ʒi., frequently repeated.

DIAPHORETICS.

What are diaphoretics?—Medicines which produce perspiration.

Are not sudorifics and diaphoretics synonymous terms?—Yes.

How would you favour diaphoresis?—By warm clothing, warm diluent drinks, by bleeding first when necessary, and by preventing other secretions, especially that of the kidneys.

What are the different classes of diaphoretics?—The nauseating, refrigerant, and alterative.

NAUSEATING DIAPHORETICS.

Ipecacuanha.—How is this used as a diaphoretic?—Generally in combination with opium.

How is the union of these two made more perfect?—By combining them with the sulphate of potassa.

What is the officinal preparation of this kind? — The powder of ipecacuanha and opium, commonly called Dover's powder.

What are the proportions of the ingredients in this powder? — Pulv. opii, gr. i; pulv. ipecac., gr. i.; potas. sulph., grs. viij.

What is the dose of this powder? — Grs. x., every four or six hours.

In what cases is this used? — In inflammatory diseases, after the reduction of the arterial excitement by the lancet, in gout, rheumatism, dysentery, &c., and in all inflammations, except that of the brain.

Tartrate of Antimony and Potassa. (*Vide supra.*)

What is the dose of this as a diaphoretic? — Gr. $\frac{1}{2}$–$\frac{1}{4}$ every hour or two.

In what cases is this applicable? — In all inflammations, except that of the stomach, or where there is a typhoid tendency.

REFRIGERANT DIAPHORETICS.

Citrate of Potassa. — What is this? — A soluble, deliquescent salt.

In what two forms is it employed? — In the form of neutral mixture, and the effervescing draught.

How is the neutral mixture prepared? — By saturating the carbonate or bicarbonate of potash with lemon-juice until effervescence ceases.

What is the proportion of ingredients when the carbonate of potash is used? — Lemon-juice, f℥iv., and add as much of the carbonate as will saturate it, and then filter, &c.

What is the proportion when citric acid is used? — Acidum citrici, ʒij., water, f℥iv.

What is the dose of neutral mixture? — F℥ss., every hour or two.

What is the composition of the effervescing draught? — Potassa carb. ʒiii.; aqua, f℥iv.; then add a tablespoonful of the solution to the same quantity of lemon or lime juice, previously mixed with a tablespoonful of water, and give the mixture in a state of effervescence every hour or two.

What is the taste of these solutions? — Pleasantly alkaline.

In what cases are they beneficial? — In fevers, with nausea and vomiting.

What are sometimes added to these mixtures?—Tart. ant. et potas., tr. opii., spts æth. nit., &c.

Acetate of Ammonia. — How is this salt employed? — In solution.

What are the officinal and common names for it?—Officinal, liquor ammoniæ acetatis. The common name is spirits of mindererus.

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How is it prepared?—By saturating distilled vinegar or dilute acetic acid with carbonate of ammonia.

What is its colour and taste?—It is clear, with a pleasant aromatic taste.

When is it used?—When a slightly stimulating diaphoretic is required.

What is its dose?—F℥jss.–f℥j., repeated every two or three hours.

Nitrate of Potassa is also used as a diaphoretic. (*Vide supra.*)

Spiritus Ætheris Nitrici. (*Vide supra*).—What is its dose as a diaphoretic?—F ʒss.–f ʒj., every two or three hours.

ALTERATIVE DIAPHORETICS.

Guaiacum Wood (*Guaiaci Lignum*); Guaiaci (*Guaiaci Resinæ*). What is the name of the tree which produces these?—The guaiacum officinale, a large tree growing in the West Indies and South America.

How is guaiacum wood imported and kept in the shops, and what are its properties?—It is imported in billets, but kept in the shops in raspings or shavings. The external colour of the billets is yellow, the internal black, and when heated has a peculiar odour; and is bitter to the taste when long chewed.

To what does it impart its virtues?—Slightly to water, and in a larger proportion to alcohol.

What is the guaiac?—The concrete juice of the tree, obtained either by spontaneous exudation, or by making incisions in the trunk, or by acting upon the billets with fire, or by boiling the raspings, &c.

How is it found in the shops, and what are its properties?—It is in reddish-brown lumps when first prepared, but becomes of an olive colour, or greenish-brown by exposure; it has a translucent, brittle, and shining fracture. The powder is at first grayish, but becomes green by exposure, and in hot weather cakes together. The taste is pungent, and the odour very feeble.

What is it chemically?—A gum resin.

What are its relations to water and alcohol?—Water acts slightly upon it; alcohol dissolves all, except its impurities.

What are its effects upon the system, and in what cases has it been used?—It is moderately stimulant, and alterative, and is a diaphoretic, diuretic, or emmenagogue, according to circumstances. It has been used in syphilis, in rheumatism, gout, amenorrhœa, cutaneous eruptions, &c.

What is the dose of it in powder?—Grs. x.–xxx.

What are the names of the officinal tinctures, and their doses?—The tinctura guaiaci, and the tinctura guaiaci ammoniata. The doses of each of these is f ʒj., three or four times a day.

In what decoction is this wood an ingredient?—In the compound decoction of sarsaparilla.

Mezereon (*Mezereum*). — What is this? — The bark of different species of the daphne, as the daphne mezereum, &c.

Describe the plant, &c. — It is a small, hardy shrub, with highly fragrant and pale rose-coloured flowers; it is a native of Europe.

Describe the bark and its properties. — It is in long strips; externally it has a grayish epidermis, beneath which is a soft, greenish tissue; the inner bark is tough, pliable, fibrous, and striated with a whitish colour; the recent bark has a nauseous smell, but the dry is inodorous; the taste is acrid.

To what does it impart its virtues? — To water and alcohol.

What are its principles? — A peculiar one, called daphnin, and an acrid resin, in which its virtues are thought to reside.

What are its effects upon the system, and when has it been used? — It is stimulant and diuretic, or diaphoretic, according to circumstances. It has been used in rheumatism, gout, scrofula, and diseases of the skin.

How is it used, and what is the dose? — It is used in decoction, in the proportion of mezereon, ʒij., and liquorice root, ʒss.; boil this in Oiij. of water to Oij.; the dose is a teacupful four times a day.

Is not this an ingredient in the comp. decoct. of sarsaparilla? — Yes.

What is the effect of mezereon bark, when externally applied? — It produces inflammation.

Sassafras. — What part of this is used? — The bark of the root of the sassafras officinale, and the pith of the small twigs.

What are the properties of the bark and the piths, as kept in the shops? — The bark is in irregular fragments, sometimes covered with a brown epidermis, and very brittle; its colour is like that of cinnamon; the odour is fragrant, and the taste sweet and aromatic. The pith is in white, slender, cylindrical pieces, light and spongy.

To what does the bark impart its virtues, and what is its active constituent? — The active principle of the bark is a volatile oil, and the bark imparts its virtues to water and alcohol.

How is the volatile oil procured, and what is its specific gravity? — The oil is procured by distillation; its sp. gr. 1·094.

What are its effects upon the system? — It is stimulant, and is chiefly prescribed in combination.

In what preparation is the bark used? — In the comp. decoc. of sarsaparilla.

What is the dose of the oil? — Gtts. v.–x.

For what is the pith used, and what are its proportions in its preparations? — It is used to impart its mucilage to water, as a collyrium, in the proportion of grs. x. to f℥j.–f℥ij. of water.

Sarsaparilla. — Of what is this the root? — Of several species of smilax, as the smilax officinalis and syphilitica, natives of Mexico, West Indies, and South America.

What is the character of the root as imported?—It is in bundles; the root is about the size of a goose-quill, wrinkled, and flexible, the cortical portion is thick; the colour is variegated, sometimes black, internally it is white, with little odour, and when taken into the mouth there is little taste, but afterwards there is a burning in the fauces.

To what does it impart its virtues?—To water and alcohol; long boiling impairs its virtues.

In what does its virtues reside?—In a peculiar principle, called sarsaparillin.

What are its effects upon the system, and in what cases has it been used?—It acts as a diaphoretic and diuretic, in large doses it purges, and in still larger, it nauseates and vomits. It has been used in secondary syphilis, in cutaneous affections, in scrofula, &c.

What is the dose of the powder?—ʒss.–ʒj., three or four times a day.

What is the composition of the compound decoction?—Sarsaparilla, sassafras, guaiacum wood, liquorice root, and mezereon. The dose is f℥iv., three or four times a day.

What is the composition and dose of the syrup?—Sarsaparilla, guaiacum, red roses, senna, liquorice root, oil of sassafras, oil of aniseed, oil of gaultheria, sugar, and diluted alcohol; the dose is f℥ss.

What is the dose of the alcoholic extract?—Grs. x.–xx. (There is also a fluid extract); dose, fʒi., three times a day.

EXPECTORANTS.

What are expectorants?—Substances which increase and facilitate the discharge of mucous or other secretions from the membrane lining the air-cells and bronchial tubes, &c.

Are not emetics in small doses expectorants?—Yes.

Sqill.—(*Vide supra.*)

How is this used as an expectorant?—In the form of the vinegar, syrup, oxymel, and tincture.

What are its characters as an expectorant, and when has it been administered?—It is stimulant, and has been employed in advanced stages of bronchial affections, after the subsidence of fever, &c.

How is the syrup or oxymel prepared from the vinegar, and what are the doses of the various preparations?—The syrup is formed by adding sugar to the vinegar, and the oxymel is formed by adding honey to the vinegar. The dose of the vinegar is fʒss.–fʒj.; the dose of the syrup or oxymel is fʒj.–fʒij.; the dose of the tincture, gtts. xxx.–xl.

Garlic (*Allium*).—What is this?—The Allium sativum, or garden garlic of Europe, but cultivated in the United States.

What is the part used, and what are its properties?—The bulb is

the part used; it is somewhat of a flattened sphere, and has the stem attached to it; it is covered with a white, dry, membranous envelope surrounding the cloves which are around the stem, each clove having a distinct envelope besides. The cloves have a peculiar odour, and a bitter acrid taste.

In what do their virtues reside? — In a volatile oil.

To what do the cloves impart their virtues? — To water, vinegar, and alcohol.

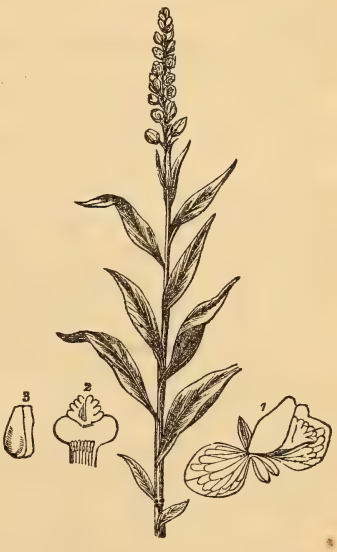
What is the common form for administration? — The juice.

What are its effects upon the system, and when has it been administered?—It is gently stimulant, and increases the various secretions. It has been used in the pectoral affections of children, in hooping-cough, &c.

What is the dose of it for a child? — F ℨss.–f ℨj.

Seneka (*Senega*). — What part is officinal? (Fig. 364.) — The root of the Polygala senega, an herbaceous, perennial plant, native in the United States.

Fig. 364.



What is the character and sensible appearance of the root? — The root is ligneous, with a large head, and tapering to a point, contorted, and appears as if a thread were inserted in the one side; the colour is yellowish or grayish-brown; the powder is gray; the odour is peculiar and strong in the fresh, but faint in the dry; the taste is sweetish and mucilaginous; and after a while irritating to the fauces. The cortical portion contains the more active part.

What is thought to be the active principle, and to what does it impart its virtues?—The active principle is Senegin, and it imparts its virtues to water and alcohol.

What are its effects upon the system, and when has it been employed? — It is a stimulant expectorant and diuretic; in large doses it is emetic and cathartic. It is used in the same cases as squills.

In what forms is it given, and what are the doses? — In powder, dose, grs. x.–xx.; in decoction, made by boiling, ℥j. of the bruised root with ℥i. of liquorice root in Ojss. of water, to Oj.; the dose

is, f℥i.–f℥ij., three or four times a day; and in syrup, dose, fʒiss.–f ʒi., two or three times a day.

What is the composition of the Syrupus scillæ compositus, or Coxe's Hive Syrup? — Squill, senega, tart. ant. et potassa, clarified honey, and distilled water: dose according to the age of the child, and the effect to be produced, either expectorant or emetic, from gtts. xv. to f ʒi.

Ammonia (*Ammoniacum*). — What is the medicine used? — The inspissated juice of the Dorema ammoniacum, an umbelliferous plant of Persia.

How is it obtained? — From punctures made in the bark of the shrub, whence the juice exudes and concretes.

In what forms does it come to us, and what are their characters? — It comes in tears and masses; the tears which are the purest are in spherical pieces, from the size of a pin's head to that of a walnut; they have a yellow exterior; interiorly they are white, shining, and very brittle; the masses appear to be the tears of inferior quality agglutinated together; they are divesifierd in structure, and contain impurities.

What are the sensible properties of ammoniac?—It has a peculiar smell, with a bitter, acrid, and sweet taste.

What is it chemically? — Gum resin, with volatile oil.

What are its relations to water and alcohol?—It is partly soluble in alcohol, and forms a milky emulsion with water.

What are its effects upon the system, and in what cases has it been used? — It is stimulating to the heart, arteries, and nerves, with a tendency to the lungs, and bronchial mucous membrane; in large doses it purges. It is used in chronic pulmonary affections, where there is diminished secretion without inflammation.

What is its dose? — Grs. x.–xxx., in pill or emulsion

What is an officinal preparation of it? — The pilulæ scillæ compositæ, composed of squill, ginger, hard soap, and ammoniac.

Assafœtida. (*Vide supra.*)

What is its character as an expectorant?—It is stimulating, with a tendency to allay nervous excitement. It has been used in chronic pectoral affections, hooping-cough, asthma, &c.

What is its dose as an expectorant? — Grs. v.–xv., in pill or emulsion.

Balsam of Tolu (*Tolutanum*). — What is this the product of? —The Myroxylon toluiferum; a tree growing in tropical America.

How is the balsam procured, in what state is it imported, and how is it kept in the shops? — It is obtained from the juice exuded, it is collected in jars, and is imported in a semi-fluid state; as found in the shops it is in various degrees of consistence, the colour is brown and translucent, the odour is fragrant and agreeable, the taste is warm, pungent, and penetrating.

What are the effects of heat and exposure, and what are its essential constituents?—It melts by heat, inflames and diffuses its peculiar odour; by exposure it becomes hard and brittle; its constituents are resin, volatile oil, and benzoic acid.

What are its relations to water and alcohol?—It is entirely dissolved by alcohol; water extracts its benzoic acid.

How may the benzoic acid be separated from it?—By distilling it with water, when the acid is sublimed.

What are the properties of benzoic acid?—It is in soft, white, feathery crystals, of a silky lustre; when pure it is inodorous and inflammable; its taste is warm and acrid; it is a constituent characteristic of the balsams.

In what preparation, and that only, is benzoic acid used?—Tr. opii, camph., or elixir paregoric.

What are the effects of tolu upon the system, and when has it been used?—It is a stimulant tonic, with a tendency to the lungs, and applicable to pectoral diseases, where a stimulating expectorant is required after inflammation has subsided.

What is the dose of tolu?—Grs. x.–xxx., in emulsion.

What is the dose of the tincture?—Fʒi.–fʒij.

Does not the balsam of Peru possess qualities similar to tolu?—Yes.

EMMENAGOGUES.

What are emmenagogues?—Medicines which favour the menstrual secretion.

What medicines, which have been mentioned before, act in this way?—The preparations of iron, aloes, black hellebore, guaiac, &c.

SAVINE (*Sabina*).—What is the medicine used?—The leaves of the juniperus sabina, an evergreen shrub, native of Europe.

What is the appearance of the plant?—Similar to the common red cedar of the United States.

What is the appearance and sensible properties of the leaves?—They are pinnate, of a green colour when fresh, ash-coloured when dry; they have a peculiar, strong, heavy, disagreeable odour, and a bitter and acrid taste.

To what do they impart their virtues?—To water and alcohol.

What are its effects upon the system?—It is highly stimulating, increasing the secretions, has a peculiar tendency to the uterus, and should not be prescribed during pregnancy.

What is the active principle?—A volatile oil, called the oil of savin—oleum sabinæ.

What are the properties of the oil?—It is of a yellow, limpid, light colour, strong odour, and acrid taste.

In what forms is savine given, and what are the doses?—In powder, dose, grs. v.–xx., two or three times a day; the oil, dose, gtts. ij.–v.

What is its character as an emmenagogue?—It is very stimulating, and is beneficial in cases of debility of the uterus.

Spanish Flies.—What is the dose of these as an emmenagogue?—The tincture is used generally; dose, gtts. x.–xxx., three times a day.

SIALAGOGUES.

What are these?—Medicines which promote the secretion of saliva; as tobacco, or any substance or root when chewed.

ERRHINES.

What are these?—Medicines which promote the secretion from the mucous membrane of the nostrils.

EPISPASTICS.

What are epispastics?—Medicines which, when applied to the skin, produce a blister.

What are the particular indications for blisters?—For general stimulation, as revulsives to change the action of a part, as local depletants to obtain a denuded surface, as auxiliaries to internal stimulants, &c.

How would you avoid strangury?—By leaving the blister on only till redness is produced.

Spanish Flies (*Cantharis*).—What are the names for the fly?—Cantharis vesicatoria, meloe vesicatoria, and lytta vesicatoria; natives of Spain and Italy.

How are they procured, and what is their appearance?—They are obtained by shaking them from the trees and shrubs to which they adhere, and immersing them in vinegar and water; they are two-thirds of an inch in length, oblong, and of a golden-green colour.

What is the colour, odour, and taste of the powder?—The powder is brownish-green, interspersed with shining particles, which are parts of the head and wing cases of the fly; the odour is disagreeable, and the taste burning and urinous.

To what do they impart their virtues?—To water and alcohol.

When insects attack the powder what is the result?—Its virtues are injured.

What is the active principle, and its appearance?—The active principle is cantharidin, a white, crystalline substance, of a shining, micaceous appearance, insoluble in water and cold alcohol, but soluble in ether and the oils.

How is the cerate of Spanish flies, commonly called blistering ointment, prepared?—By taking powdered flies, yellow wax, resin, and olive oil; melting together, first the wax and resin, and then adding powdered flies, and stir the whole constantly until it cools.

How is the ointment of Spanish flies prepared?—By taking pow-

dered flies and distilled water, and boiling down the water with the flies to one-half the original quantity; mixing cerate with the strained liquor, and evaporating to a proper consistence.

How is the plaster of pitch and Spanish flies prepared?—By mixing together Burgundy pitch and fly cerate, by means of a water-bath, stirring constantly.

How is the linimentum cantharidis prepared?—By taking powdered flies and oil of turpentine, digesting the flies in it for three hours, and then straining.

What preparation has recently come into use which is of importance for vesicating, particularly in cases of children?—The cantharidin collodion.

Potato Flies (*Cantharis Vittata*, or *Lytta Vittata*).—Where are these native, and on what plants are they found?—They are native of the United States, and are found upon the sweet-potato vines.

What is their appearance?—They are less than an inch in length, with a head of a light red colour, and dark spots on the top, the wing cases are black, with a yellow, longitudinal stripe in the centre, and a yellow margin.

RUBEFACIENTS.

What are these?—Medicines which, when externally applied, inflame the skin.

In what cases are they applicable?—When you wish a slight but continued impression.

Mustard (*Sinapis*).—What is this medicine?—The seeds of the sinapis alba and S. nigra, natives of Europe, but cultivated in the United States.

Describe the plant and the seeds.—The black mustard is a tall plant, with leaves of various characters; the flowers are small and yellow, the pods are smooth, and contain numerous seeds; the seeds are small and globular, of a brown colour externally, internally yellow; when whole they are inodorous, but when powdered they have a distinct smell; the taste is bitterish, hot, and pungent. The white mustard is a smaller plant than the black, the flowers are in racemes, the pods are spreading, rugged, and roundish, &c., the seeds are larger than the black, of a yellowish colour, and of a less pungent taste. They are both yellow in powder.

What do they contain?—Mucilage, and a fixed oil.

What are the effects of mustard upon the system?—When taken whole internally they are laxative, when bruised they are emetic, and when moistened in powder, and applied upon the body, they are rubefacient. It is beneficial in any case where rubefacients are applicable.

In what way is it used as a rubefacient?—By making a poultice with the powder in water or vinegar, and spreading it on muslin or leather.

What two substances which we have described before are rubefacients? — Cayenne pepper, and oil of turpentine.

BURGUNDY PITCH (*Pix-Abietes*). — What tree produces this? — The abies communis, a large evergreen tree of the north of Europe, commonly called Norway spruce fir.

How is it procured and prepared for use, and how is it found in the shops?—It is procured, &c., by laying bare the wood of the tree, and allowing the juice to concrete, and then boiling it in water and afterwards straining it; as found in the shops it is in large, brittle, and opaque masses.

What are its sensible properties, and the effects of heat upon it, &c.? — It is of a yellowish-brown colour, of a weak terebinthinate odour and taste, and becomes darker by exposure; it is fusible by heat.

What kind of a rubefacient is this? — A very mild one.

What is it chemically? — A gum resin.

How is it used? — As a plaster.

LIQUOR AMMONIÆ, OR SOLUTION OF AMMONIA. — What is the ordinary name for this? — Water of ammonia, aqua ammoniæ.

How is it prepared?—By passing the fumes arising from the combination of hydrochlorate of ammonia and lime into water.

What is its odour? — Pungent and acrid.

What is its character as a rubefacient? — It is a very powerful one.

What are its relations to the oils? — It combines with them and forms soaps.

What is volatile liniment? — A combination of one part of aqua ammoniæ with two or three parts of olive oil.

What is Granville's lotion? — A combination of aqua ammoniæ, camphor, and rosemary.

ESCHAROTICS.

What are these?—Substances which, when applied to any part of the body, destroy its life and produce a slough.

What are some of these? — The actual cautery, or white-hot iron; the moxa, or small combustible masses, to be burnt upon the skin, which are made of spunk, or cotton rolled up and saturated with a solution of nitre or bichromate of potassa, &c.

POTASSA. — What is this? — The common caustic.

How is it prepared? — By evaporating a solution of potassa over the fire until ebullition ceases, and the potassa melts, and then pouring it into moulds.

What is its appearance? — It is in cylindrical pieces, of various sizes; it has a dingy gray or green colour; it is very deliquescent, and should be kept in green glass bottles, with accurately-fitted stoppers.

What are its impurities? — The sulphate of potassa, chloride and peroxide of potassium, peroxide of iron, lime, &c.

For what and how is it used? — It is used to form issues, to open abscesses, to destroy poisoned surfaces. It is applied by cutting a hole in a piece of adhesive plaster, placing it upon the part of the body to be cauterized, and then moistening the end of the caustic, and applying it through the hole in the plaster.

NITRATE OF SILVER. — What is the common name for this? — Lunar caustic. (See *Chemistry*, and ARGENTUM, under *Tonics*.)

How is it applied?—Either in the solid stick, or in solution.

What is its character as an escharotic, and when has it been used? —It is mild and efficient, and easily managed. It has been used to destroy the surfaces of bad ulcers, of warts, strictures, fungous granulations, &c.

ARSENIOUS ACID (*Acidum Arseniosum.*) (See *Chemistry.*)

How is this found in the shops, and for what may it be mistaken? —In a white opaque powder, without odour, and with a bitter, austere taste, and it may be mistaken for magnesia.

What is its character as a caustic?—It is powerful and dangerous. It has been used in cancer, and in malignant tumours generally.

Is it soluble in water? — Yes.

SULPHATE OF COPPER. (See *Chemistry*, *et supra.*)—What is the proportion of it in its caustic solution? — ℈j.–f℥j. of water.

CORROSIVE CHLORIDE OF MERCURY (*Hydrargyri Chloridum Corrosivum.*) (See *Chemistry.*)—What is this?—The bichloride of mercury or corrosive sublimate.

How is this used? — In solution.

In what state is it obtained by sublimation? — In a white, transparent, ponderous mass, with an acrid, styptic, durable taste. It is powdered for use.

Is it soluble in water and alcohol? — Yes.

What are its incompatibles? — Many of the metals, the alkalies, and their carbonates, soap, and lime-water, tartar emetic, nitrate of silver, &c.

Does it easily salivate? — No.

When given in over-doses, what are its effects and the antidote? — It is a corrosive poison. The antidote is albumen, the sulphate of iron, and demulcents.

What is its dose? — Gr. $\frac{1}{8}$–$\frac{1}{4}$, three or four times a day, in pill or solution.

Where has this been applied? — In onychia maligna, in syphilitic ulcers, and cutaneous eruptions.

Is the dried alum, or Alumen exsiccatum, very efficient as a caustic? — No.

How is it prepared? — By driving off the water of crystallization, by heat, from common alum.

Which of the mineral acids are used as caustics? — The sulphuric and nitric.

DEMULCENTS.

What are these?—Unirritating substances, which form with water a viscid solution.

What are their constituents?—Gum, sugar, and starch.

How and for what are they used?—They are either used in solution, to irritated surfaces, or they are combined with more acrid substances, to destroy their acrimony. They are used as diet for the sick, in pharmacy to suspend insoluble substances in water, also to make pills and troches.

Gum Arabic (*Acacia*).—Of what is this the product?—Of different species of acacia, thorny trees, growing in Africa and Arabia.

How is it procured, and what are the varieties used in medicine?—It exudes spontaneously from the bark of the trunk and branches; and hardens by exposure; it reaches us from Smyrna, Trieste, Marseilles, &c.; and the varieties used in medicine are the Turkey and Senegal.

Describe these varieties?—Turkey gum consists of small, irregular fragments, slightly tinged with yellow, and is the best. The Senegal gum is in roundish, unbroken pieces, of a yellowish or reddish-brown colour, larger than the Turkey gum, and less brittle and pulverizable.

What are the sensible properties of gum?—It has various tinges of colour; it is inodorous, of a feeble, sweetish taste, and when pure dissolves entirely in the mouth. Its powder is white.

In what is it soluble?—In water.

What are the effects of exposure upon the solution?—It thickens it, and it ferments.

For what is it chiefly used?—As a vehicle for other medicines, to make pills, and as a diluent drink.

Tragacanth (*Tragacantha*).—Of what is this the product?—Of several species of astragalus, small, thorny shrubs of Greece and Asia Minor.

How is it collected, and what are its properties, &c.?—It exudes spontaneously during the summer from the stems and branches of the shrubs, and hardens, assuming various shapes; of a whitish colour, translucent, and resembling horn; it has very little smell or taste.

How is it pulverized?—By exposing it to great cold, or to great heat, and pounding it in a heated mortar.

Does it dissolve in water?—No; but it forms a very adhesive paste with it.

What is its composition?—Gum and bassorin.

Slippery Elm Bark (*Ulmus*).—What is this?—The inner bark of the ulmus fulva or slippery elm, an indigenous tree.

How is the bark prepared?—The bark is stripped off from the tree, the epidermis separated from it, and the bark then dried.

Describe it.—It is in long, nearly flat pieces, of a fibrous texture, of a tawny colour, of a sweetish, not unpleasant taste, and odour; it is very mucilaginous, and imparts its mucilage to water.

How is the infusion prepared?—In the proportion of ℥j. to Oj. of water.

For what is the powder used? — To make poultices.

Flaxseed (*Linum*).—Of what is this the product? — The linum usitatissimum, or common flax.

What are the active principles? — A fixed oil, and mucilage.

How is the oil prepared? — By expression.

What is the appearance of the oil? — It is of a yellowish-brown colour, of a disagreeable odour, and nauseous taste.

How do you extract the mucilage? — By hot water.

How is the infusion made? — With the seeds, ℥j. to Oj. of water.

For what are the powdered seeds used? — To form poultices.

Fig. 365.

Liquorice Root (*Glycyrrhiza*); Liquorice (*Extractum Glycyrrhizæ*).—Of what is this the root? — Of the glycyrrhiza glabra, a plant, native of the south of Europe, it comes to us from Messina and Palermo, in Sicily (Fig. 365.)

Describe the root, &c. — It is in long pieces, varying in thickness, fibrous, and externally grayish-brown and wrinkled; internally, yellowish and without smell, of a sweet, mucilaginous taste, with now and then a slight acrimony. The powder is grayish-yellow.

To what does it impart its virtues? — To water.

What is its peculiar principle? — Glycyrrhizin.

In what form is the root used?—In decoction, ℥j. to Oj. of water; in powder to prepare pills, &c.

How is the extract prepared, and what are its sensible qualities, &c.?—It is made by cutting up the root, boiling it in water until the liquid is saturated, straining the decoction and evaporating it. It is in cylindrical rolls, very black, brittle, and dry; breaks with a shining fracture; it has a sweet, slightly acrid or bitterish taste, and is soluble in water.

What are its impurities? — Starch, sand, juice of prunes, &c.

What is the appearance of the refined liquorice? — It is in small, brilliantly black pieces, of the size of a quill.

Sago.—Of what is this the product? — Of the Sagus rumphii, or sago palm of the East Indies.

Whence is it obtained, and how is it prepared? — It is obtained from the pith of the trunk of the tree, in the shape of a coarse powder, which is mixed with water, afterwards strained, and allowed to subside; the farina left in solution is then worked up.

What are the two varieties? — The pearl and common sago.

What are the characters of the two varieties? (Fig. 366.) — The pearl sago is in small grains, of the size of a pin's head, white, inodorous, and with little taste. The common sago is in larger grains, of more unequal size, of a duller aspect, and mixed with more or less dirty powder.

Fig. 366.

What are its relations to water? — It is insoluble in cold water, and by long boiling at first becomes soft, transparent, ultimately gelatinous; it is almost all starch.

What are the proportions for the decoction? — ℥j. to Oj. of water.

Tapioca.—Of what is this the product?—The Jatropha manihot, a plant of tropical America, but cultivated in the West Indies, Brazil, &c

What are the two varieties?—The sweet and the bitter; the sweet is perfectly harmless in the recent state, while the bitter is poisonous.

How is the tapioca prepared?—By washing, scraping, and grating the root of the plant to a pulp, which in the acrid variety is submitted to pressure and heat, so as to separate the deleterious juice, &c.

Describe tapioca.—It is in the shape of hard, white, rough grains, with little taste, and partially soluble in cold water.

ARROWROOT (*Maranta*).—What is this the product of?—The Maranta arundinacea and other species, plants of the West Indies, and cultivated in the United States.

Whence is it obtained, and how is it prepared?—It is obtained from the root by first washing the root, then beating it into a pulp, which is thrown in water, and agitated to separate the starch from the fibrous portion, the fibres are removed by the hand, the starch remains in the water, the water is strained and the starch allowed to subside; and this is again washed and dried in the sun.

What are the sensible properties, &c., of arrow-root as brought to market?—It is a light, white powder, or in small pulverulent masses, without smell or taste. It is highly demulcent and nutritious, and forms an excellent article of diet.

Is it liable to mustiness?—Yes.

How is it used?—By boiling it in water or milk, in the proportion of ℥j. to Oj. of water or milk, and flavouring it with spices, sugar, &c.

What is frequently substituted for arrow-root?—The starch of the potato.

BARLEY (*Hordeum*).—How is barley prepared for medical purposes?—By depriving the grains of their hulls, and afterwards rounding and polishing them in a mill.

What is its appearance as thus prepared, and what name does it assume?—It is in round or oval grains, the longitudinal furrow of the seeds still existing upon them, and of a pearly whiteness; hence called pearl barley.

What are the constituents of pearl barley?—It abounds in starch, with some gluten, sugar, and gum, but is destitute of hordein.

How is it used?—In decoction.

How is barley water made?—By first boiling the barley with a little water for a short time, then throwing this water away, and then boiling the barley again in fresh water, and adding sugar, lemon-juice, liquorice-root, raisins, &c.

ANTACIDS.

What are these?—Substances capable of neutralizing acids.

Which of these have been mentioned under previous heads?—Carbonates of potassa, ammonia and its preparations, magnesia and its compounds, &c.

Carbonate of Soda (*Sodæ Carbonas*).—From what is the medical carbonate formed?—From the impure carbonate.

What is its appearance?—It is a white, efflorescent salt, crystallizing in large rhomboidal prisms, opaque without, but semi-transparent within.

What is its taste and solubility?—It has an alkaline caustic taste, and is easily soluble in water.

How is it best prepared for use?—By drying it.

What is the dose of the dry or anhydrous salt?—Grs. x.–xxx.

Bicarbonate of Soda (*Sodæ Bicarbonas*).—What was this formerly called?—The supercarbonate.

How is it prepared?—By saturating a solution of the carbonate with carbonic acid gas, then crystallizing it.

What is its taste and solubility?—It is slightly alkaline and very soluble.

What is the dose?—ʒss.–ʒj.

Lime (*Calx*).—How is this employed?—In solution, as lime-water.

How is this prepared?—By taking half a pound of lime and twelve pints of water, shaking them well together and allowing the lime to subside, and keeping it in well-stopped bottles.

What effect has exposure upon it?—It takes carbon from the air, and becomes milky, or a carbonate of lime is formed.

How is the carbonate of lime used?—In the form of chalk.

How is this prepared for use?—By washing a solution of common chalk with water, then allowing the chalk to subside, and then pouring off the water.

What is the dose of this?—Grs. x.–xx.–xxx.

ANTHELMINTICS.

What are these?—Medicines capable of destroying worms in the alimentary canal.

Pink Root (*Spigelia*).—What is this?—The root of the spigelia marilandica, a perennial plant of the Southern States. (Fig. 367.)

What are the characteristics of the root?—It consists of numerous, slender-branched, crooked, wrinkled fibres, from three to six inches in length, attached to a knotty head. It is of a yellowish-brown colour externally, of a faint smell, and a sweetish, slightly bitter taste. Its powder is fawn-coloured.

What are its effects upon the system?—In small doses it has little effect, in larger it purges, and in over-doses, it excites the circulation, and acts upon the brain, producing vertigo, dizziness, and sometimes convulsions. It is one of the best anthelmintics.

To what does it yield its virtues?—To water and alcohol.

In what form is it used, and what are the doses?—It is used in powder; for a child, grs. x.–xx., night and morning; in infusion. made with ℥ss. to Oj. of water; dose, f℥ss.–f℥j., two or three times a day.

Fig. 367.

Fig. 368.

Worm Seed (*Chenopodium*). — What is this medicine? — The seeds of the chenopodium anthelminticum, or Jerusalem oak, an indigenous plant. (Fig. 368.)

In what do the properties of the plant exist? — In the volatile oil.

What is the appearance of the seeds? — They are about the size

of the head of a pin, irregularly spherical, very light, and of a dull greenish-yellow colour, and when deprived of their capsule are shining, and of a dark colour.

What is its character as an anthelmintic? — It is one of the best.

How is it administered, and what is the dose?—In the seeds powdered, dose, ℈j.–℈ij.

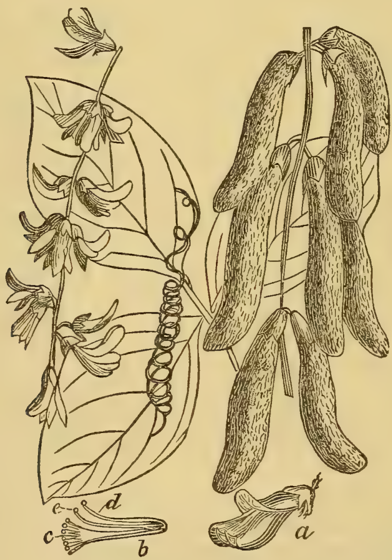
Is the volatile oil officinal? — Yes.

How is it procured? — It is procured by distillation, and is of a light yellow colour when recently distilled, but becomes brown by age.

What is its dose? — Gtts. iv.–viij. night and morning.

COWHAGE (*Mucuna*).—What is this the product of?—The mucuna pruriens, a climbing plant of the West Indies. (Fig. 369.)

Fig. 369.



What is the appearance of the fruit? — It is a pod, semilunar in shape, covered with brown hairs, which are easily separated from it; the brown hair is the part used.

How is it administered? — With molasses and syrups.

What is the dose of it? — For an adult, ℥ss.; for a child, three or four years old, ʒj.

What other articles are anthelmintic? — The bark of the pomegranate root, oil of turpentine, tin, and calomel.

MEDICINES UNCLASSIFIED.

Ergot (*Ergota*).—What other names has this? — Spurred rye, or secale cornutum. (Fig. 370.)

Fig. 370.

Of what is this the product, and how is it supposed to be formed? —It is the product of the common rye, occurring in marshy districts, and supposed to be caused by a diseased state of the grain; of the primary cause of this diseased state authors differ. (See *Dispensatory*.)

Describe the ergot. — The grains are from six lines to an inch in length, from half a line to a line in thickness, curved and marked with a longitudinal groove; they are of a light-brown colour externally, yellowish-white within, and of an unpleasant smell and acrid taste.

To what does it impart its virtues? — To water and alcohol.

What are its effects upon the system, and when has it been administered?—In small doses it produces no effect upon the male, but upon the female, it has a tendency to the uterus; when too long-continued and too freely used it causes dry, gangrene, typhus fever, and general derangement of the nervous system. It is prescribed to promote uterine contraction.

In what form is it administered, and what are the doses? — In powder, dose, grs. x.–xx.; in wine, dose, f ʒj.–f ʒiij.; in infusion, made by adding ʒj. to f ℥iv. of water: dose, f ℥j.

Nux Vomica. — What is the tree from which this is derived, and what is the part used?—The tree is the strychnos nux vomica of the West Indies; the seeds are the part used.

Describe the seeds. — They are flat and circular, somewhat curved, three quarters of an inch in diameter; they are covered with fine,

silky, ash-coloured hairs, attached to a thin membrane investing the kernel, which is hard and horny, whitish, and of difficult pulverization; they have no odour, but a very bitter, acrid taste.

What are the active principles, and to what do they impart their virtues?—The active principles are strychnia and brucia; the more important is strychnia: they impart their virtues to water and alcohol.

Describe strychnia.—When rapidly crystallized it is in the form of a white, granular powder, without odour, but of a very bitter, acrid, slightly metallic taste; it is neither volatilizable nor fusible, and is only melted at the point of decomposition. It is slightly soluble in water, but more so in alcohol.

From what is strychnia obtained for use?—From the bean of St. Ignatius.

What are its effects upon the system, and in what cases is it used?—It has a decided tendency to the nervous system, causing twitching of the muscles, contraction and spasm of the tendons; it causes heat in the stomach, constriction of the abdomen, &c. It has been prescribed in paralysis, where there is no effusion in the brain.

What are the poisonous effects of nux vomica or strychnia?—Great anxiety of countenance, difficult and confined respiration, universal tremors, and violent convulsions.

What is the dose of nux vomica and strychnia?—Of the powder of nux vomica, grs. v.; of alcoholic ext. gr. ss.–ij.; strychina, gr. one-twelfth to one sixth.

How is strychnia used externally?—By sprinkling it upon blistered surfaces.

Arsenic. (See *Chemistry.*)—Is arsenic probably inert in the metallic state?—Yes.

What are the effects of the arsenical preparations?—In very small doses they may be taken for a great length of time with impunity; in somewhat larger doses, continued, œdema of the face and limbs is produced, followed by nausea, tremors, muscular debility, &c.; in very large doses they are poisonous.

In what cases have they been found beneficial?—In intermittent fevers, in cutaneous affections, secondary syphilis, deranged nervous action, &c.

How would you treat the poisonous effects of arsenic?—By first evacuating the stomach, then administering the hydrated sesquioxide of iron, in large doses, followed by demulcents.

How is this only antidote for arsenic prepared?—By treating a boiling solution of crystallized sulphate of iron with nitric acid, as long as orange-coloured fumes are given off; then diluting and filtering the liquor, and then precipitating by an excess of ammonia; wash the precipitate, keep it under water, and give it in any amount. Acetate of iron has lately been used with still better effect than the preparation of the hydrated sesquioxide.

What two preparations of arsenic are recognised in medicine?—The arsenious acid, and the solution of the arsenite of potassa, or Fowler's solution. (See *Chemistry*.)

What is the dose of these two?—Of arsenious acid, gr. one-twelfth, in pill; of Fowler's solution, gtts. iv. to x., two or three times a day.

PREPARATIONS OF MERCURY.

What is there peculiar in the action of mercury?—In small doses it acts slowly, but efficiently, as an alterative upon the system; when more freely employed it salivates, and in large doses it purges.

MERCURIAL OINTMENT (*Unguentum Hydrargyri*).—How is this made?—By taking purified mercury, lard, and suet; rub the mercury with the suet and a small portion of lard till the globules disappear, then add the remainder of the lard, and mix the whole thoroughly.

What is its appearance?—Bluish when fresh; but it becomes darker when kept.

For what purposes is it used?—To dress blistered surfaces, to rub on the skin, to favour its absorption, &c.

MERCURIAL PILLS (*Pilulæ Hydrargyri*).—What is the ordinary name for these?—Blue pills.

How are they prepared, and what is the dose?—They are made by rubbing together purified mercury, confection of roses, and powdered liquorice, until all the globules of mercury disappear.

Is not this the mildest preparation of mercury?—Yes.

What is the officinal pill?—Grs. iij.

What is the dose of it?—One pill three times a day, or one night and morning.

MERCURY WITH CHALK (*Hydrargyrum cum Creta*).—How is this prepared?—By taking purified mercury and calc. carb. prep. and rubbing them together until all the globules of mercury disappear.

In what cases is this applicable?—As an alterative in diseases of children.

What is the dose?—Grs. v.–xx., twice a day.

RED OXIDE OF MERCURY (*Hydrargyri Ox. Rubrum, or Red Precipitate*).—How is this prepared?—By boiling, in a glass vessel, with nitric acid and distilled water, purified mercury until it is dissolved; a white mass will remain after the water is evaporated; rub this in a powder, and throw it into a shallow vessel, and apply heat, and gradually increase the heat until red vapours cease to rise.

What is its appearance?—Of a brilliant red colour, shining and scaly, with a shade of orange.

How, and in what cases has it been used?—As an escharotic and stimulant in chancres, indolent and flabby ulcers, by sprinkling it on the surface, &c.

Is it soluble in water? — Yes, slightly.

What is the name of the officinal ointment? — Unguentum hydrargyri oxidi rubri.

How is the nitrate of mercury used? — In the form of an ointment, called citrine ointment (unguentum hydrargyri nitratis).

What is the colour of the ointment? — When recently prepared it is of a beautiful yellow colour, but it becomes greenish by time. (For the other and numerous preparations of mercury, see the *United States Dispensatory*.)

IODINE (*Iodinum*). — (For its preparation and chemical relations, see *Chemistry*.)

What are its characteristics?—It is a soft, friable, opaque solid, in crystalline scales; of a bluish-black colour, and metallic lustre; it has a strong, peculiar odour, and an acrid taste; it is slightly soluble in water, and much more soluble in alcohol and ether.

What are its effects upon the system, and in what cases has it been used?—In small quantities it is tonic, but if too long continued, it produces emaciation and absorption; and, in large doses, it is poisonous. It has been prescribed in goître, and in diseases of the glandular and absorbent system generally.

What is the dose of it?—From $\frac{1}{4}$ to $\frac{1}{2}$ a grain, three times a day.

What is the proportion of iodine in the tincture, and what is the dose?—The iodine is in the proportion of ℥ss., to alcohol, Oss.; the dose is from gtts. x.–xv.

IODIDE OF POTASSIUM (*Potassii Iodidum*). — How is this prepared? — By applying heat to a solution of potassa; and adding, by degrees, sufficient iodine to saturate the potassa and give to it a brown colour, and then passing through it hydrosulphuric acid gas till it loses its brown colour, and retains the odour of the acid; then filter through paper, and after throwing hot water on the residue filter again; boil the filtered liquor for a short time, clear the liquor from any impurities, and boil to dryness.

Describe it.—It is a deliquescent salt, of an opaque, white colour, with an acrid and slightly bitter taste; it is soluble in two-thirds of its weight of cold water, and is converted into the hydriodate; it dissolves freely in alcohol.

What is its dose? — Grs. v.–x., two or three times a day.

What is the advantage of the solution?—It affords an easy method for dissolving iodine.

COMPOUND SOLUTION OF IODINE (*Liquor Iodini Compositus*). — With what is this identical? — Lugol's solution.

What is the dose of it? — Gtts. vi., three times a day.

How is iodine externally used? — In baths or ointment.

What is the composition of the ointment?—℈j. of iodine to ℥j. of lard. (For the other preparations of iodine, see *Dispensatory*.)

MEDICAL FORMULARY.

The doses appended, and the modes of administration described, are appli-cable to adults, if not otherwise mentioned.

ASTRINGENTS.

1. Decoction of white oak bark.

℞ Cort. Querc. Albæ. contus. ℥i.
Aqua, Oiss. M.
S. Boil to a pint and strain.

2. Tannin pills.

℞ Acid Tannic, grs. viii.–xij.
Syrup simp. q. s. ut.
Ft. Pil. No. viii.
S. One every two or three hours. In gonorrhœa.

3.

℞ Acid Tannic, ℈i.
Morphiæ Sulphatis, gr. i.
Mucilag. Acac., q. s.
Ft. Pil. No. x.
S. Take one every two or three hours. Blue mass may be added according to circumstances. In diarrhœa and dysentery.

4.

℞ Acidi Gallici, ℈i.
Ext. Gentianæ, grs. x.
Syrupi, q. s.
Ft. Pil. No. x.
S. One every 3 hours in hemorrhages.

5. Ointment of galls.

℞ Pv. Gallarum, ʒii.
Adeps, ℥viii.

6. Compound ointment of galls.

℞ Pv. Gallarum, ʒii.
Pv. Opii, ʒss.
Adeps, ℥ii.

7. Gargle of galls and alcohol.

℞ Infus. Gallarum, f℥vii.
Spts. Vin. Rect. f℥i. M.
S. For relaxation of the uvula.

8. Astringent draught.

℞ Infusum Gallarum, f℥iv.
Creta, prep. ℥ss.
Tr. Opii.
Gum Acaciæ, āā ʒi.
S. A tablespoonful every two hours.

9. For vaginal injections.

℞ Pv. Gallarum, ℥ss.
Aqua, f℥xviii. M.
S. Boil to f℥xvi.

10. Ointment for hæmorrhoides.

℞ Acid Tannic, ℈i.
Cerat Plumbi Subacet, ℥i.
Ext. Stramonii, ʒi. M.

11. Injection for leucorrhœa.

℞ Ext. Gallarum, ℈i.
Spts. Vin. Rect. f℥i.
Aqua Cologne, f℥i. M.
S. Put fʒi. to two gills of water, and use as injection.

12. Ointment for hæmorrhoides.

℞ Pv. Gallarum, ℥ss.
Pv. Opii, ʒi.
Camphora, ʒi.
Adeps, ℥ii. M.
S. Apply three times a day.

13. For hæmorrhoides.

℞ Pv. Gallarum, ʒi.
Pv. Opii, grs. x.
Tar, ℥i. M.
S. Use as above.

14. Syrup of galls.

℞ Pv. Gallarum, ʒii.
Brandy, gill i. M.
S. Put the brandy into a shallow vessel, and place over it on wires sugar lumps, q. s., set fire to the brandy, and as the sugar melts a syrup will form. Dose, a teaspoonful every hour or two.

15. In diarrhœa.

℞ Pv. Kino, grs. ʒxv.
Cinnamomi, ℥ss.
Opii, ʒi. M.
S. Dose, grs. v.–xx.

16. Pills of kino and camphor.

℞ Pv. Kino, ℈ii.
Camphora, ℈iss.
Pv. Aromat. ℈i.
Zinci ox. grs. x. M.
Ft. pil. No. xx.
S Two morning and night in debility.

17. Astringent expectorant.

℞ Pv. Kino, grs. vi.
Alum et Potas. sulph.
Pv. Canella, āā ʒii.
Syr. simplex. q. s.
S. Give a teaspoonful every two or three hours.

18. Stimulant pills for gonorrhœa.

℞ Pv. Kino, ℥ss.
Canada Balsam, ℥ii.
Rad. Torment. pv. q. s.
S. Ft. Pil., grs. v. āā.

19. Chronic diarrhœa.

℞ Infus. Cascaril. f℥vi.
Pv. Kino comp. ʒi.
Syr. Papav. fʒiv. M.
S A tablespoonful every six hours.

20. Compound infusion of catechu.

℞ Catechu, ℥ss.
Cinnam. contus, ʒi.
Aqua bullienti, Oi. M.
S. Macerate an hour and strain. Dose, f℥i. to f℥iij., three or four times a day.

21. For passive hemorrhages.

℞ Alum, grs. vi.
Pv. Opii, gr. i.
Catechu, gr. i. M.
Ft. Pil. No. vi.
S. One every two or three hours.

22. Compound powder of catechu, for chronic diarrhœa.

℞ Catechu, pv.
Cascarilla, pv.
Gum Acaciæ, pv.
Pv. Aromat. āā, partes equales.
S. ℈i. every two hours.

23. For gonorrhœa.

℞ Pv. Catechu, grs. xii.
Alum, grs. vi.
Pv. Opii, grs. ii. M.
Ft. Pil. of grs. v. āā.
S. One or two during the day.

24. Ointment of catechu for ulcers.

℞ Pv. Catechu, ℥lv.
Alum, ʒix.
Adeps, ℥iv.
Ol. Oliv. ℥x.
Aqua, q. s. M.

25. For diarrhœa.

℞ Mist. Cretæ, f℥iss.
Tr. Opii, gtt. x.
Catechu, fʒi. M.
S. Take every three hours.

26. In uterine hemorrhage

℞ Infus. Rosarum, f℥iv.
Syr. Catechu, f℥i.
Acid Sulph. Aromat. fʒi. M.
S. A tablespoonful every hour.

27. Ulcerations of the mouth.

℞ Catechu, fʒii.
Mel. Rosarum, fʒx. M.

28. For diarrhœa, after a watery stool.

℞ Infus, Krameria, f℥iv.
Syr. Catechu, f℥viii.
Syr. Papav. f℥i.
Succi Cydoniæ, or Quince, f℥i. M.
S. A teaspoonful every hour.

29. Infusion of rhatany for injection.

℞ Rad. Kram. contus. ℥i.
Aqua bullienti, Oi. M.
S. Macerate for four hours and strain. It is better made by displacement.

30. Pills of rhatany.

℞ Ext. Rhat. ℈i.
Pv. Kino, q. s. M.
Ft. Pil. No. viii.
S. One pill every hour or two, in hemorrhage and dysentery.

31. Mixture of ext. rhatany.

℞ Ext. Rhat. ʒi.
Syr. Papav.
Aqua Rosarum, āā ℥i. M.
S. A teaspoonful, pro re nata, in passive hemorrhage, dysentery, &c.

32. Gargle.

℞ Infus. Rhatany, f℥viii.
Acid Sulph. diluti. ʒii.
Syr. Ros. Gall. ℥i. M.

33. Astringent gargle.

℞ Ext. Rhatany, ʒiv.
Aqua, f℥x.
Add to the solution
Acetæ Acid, f℥iv.

34. For dysentery, diarrhœa.

℞ Ext. Hæmatox. ʒiii.
Tr. Catechu, fʒii.
Aqua, f℥vii. M.
S. Two teaspoonfuls every three or four hours.

35. For the same.

℞ Ext. Hæmatox. ʒiii.
Aqua distil. f℥vii.
Tr. Kino, fʒii. M.
S. Two teaspoonfuls every three hours.

36. For the same.

℞ Rad Cort. Rubus. ℥i.
Aqua, Oiss. M.
S. Boil to a pint. Dose, f℥i.–f℥ii., three or four times a day.

37. For irritation of the kidneys and bladder.

℞ Uva Ursi, ℥i.
Sem. Lini, ℥ss.
Bac. Junip. ʒii.
Aqua, f℥xx. M.
S. Boil to a pint and strain. Dose, f℥i.–f℥ij., three or four times a day.

38. Powders of uva ursi and soda.

℞ Pv. Uva Ursi, ʒiss.
Sodæ bicarb. ʒi. M.
Ft. chts. No. xii.
S. One, three or four times a day

39. Powders of uva ursi and bark.

℞ Pv. Uva Ursi,
Cinchon. āā ʒi.
Opii, grs. iii. M.
Ft. chts. No. vi.
S. One, three or four times a day.

40.

℞ Decoct. Uva Ursi,
Liq. calc. āā ℥iv. M.
S. f℥ii. four times a day.

41.

℞ Uva Ursi,
Baccæ., Junip. āā ℥ss.
Macerate in Aqua fervent, Oii.
Strain and add
Syr. simplex, f℥ii. M.
S. A tablespoonful, three times a day.

42. Compound solution of alum.

℞ Alum,
Zinci sulph. āā ℥i.
Aqua bullienti, Oiii. M.
S. Dissolve the alum and sulphate of zinc in the water, and then strain. N.B. This has also been called Bate's Alum Water.

43. Compound powders of alum.

℞ Alum, pv. ℥iv.
Kino, pv. ℥i. M.
Ft. Pulv., dose v.–xx. grs., for diarrhœa and dysentery.

44. Bolus of alum and ext. bark.

℞ Alum, pv.
Ext. Cinchonæ.
Pv. Myristice, āā grs. x.
Syr. simp. qs. ut ft. M.
S. Bolus for uterine hemorrhage.

45.

℞ Pv. Alum, grs. xii.–xx.
Aqua Rosarum, f℥iv. M.
S. For chronic inflammation of eyes.

46. Cavana's alum gargle.

℞ Alum, ʒii.
Aqua, ℥iv.

47. Mixture of alum and ext. bark.

℞ Alum, ℈ii.
Ext. Cinchon. ℥ss.
Aqua Cinnam. ℥v.
Syr. Limonis, f℥i. M.
S. Two teaspoonfuls every two hours in hemorrhage.

48. Alum whey.

℞ Lactis Vaccin. bullient. Oi.
Pv. alum, ʒii.
S. Boil till coaguli separates, and strain. A cupful occasionally.

49. Ointment of alum and calomel, for tinea capitis.

℞ Hydr. chl. mite, ʒii.
Alum Exsic.
Ox. Plumb. alb. āā ℥ss.
Ol. Terebinth, ʒii.
Cerat. simp. ℥iss. M.

50. For internal passive hemorrhages; leucorrhœa, &c.

℞ Pv. Alum, grs. x.
Kino, grs. v.
Confect. Rosarum, ʒi. M.
S. A bolus every six hours.

51. Gargle in relaxation of uvula, &c.

℞ Alum, ʒi.
Cinch. decoct. f℥xii.
Mel. Rosarum, ℥iss. M.

52. Gargle of Hotel Dieu.

℞ Alum, ʒi.
Mel. Rosæ, ℥ii.
Decoct. Hord.
Rosam, āā ℥i. M.

53. Guy's Hospital collyrium.

℞ Alum, ℈i.
Aqua Rosæ, ℥viii. M.

54. Injection for gonorrhœa.

℞ Alum, ʒiss.
Plumb. Acet. grs. vi.
Tr. Opii, ʒss.
Aqua, ℥vi. M.

55. Injection for gonorrhœa.

℞ Alum, ʒi.
Pv. Kino, ʒii.
Muc. Acaciæ, f℥i.
Aqua, Oi. M.

56. In diarrhœa.

℞ Plumbi Acet. ℈i.
Pv. Opii, qrs. vi.
Muc. Acac. q. s.
Ft. Pil. No. xii.
S. One every hour.

57. In cholera infantum.

℞ Plumbi Acetat, grs. v.
Aceti, gtts. v.
Sacchari, ʒi.
Aquæ f℥i. M.
S. A teaspoonful every hour or two to a child, to allay vomiting in cholera infantum.

58. Pills for cholera infantum.

℞ Plumbi Acet. ʒss.
Hyd. chl. mit. grs. v.
Confect. Rosar. q. s. M.
Ft. Pil. No. x.
S. One every two or four hours in hemorrhage, &c.

59. In cholera infantum.

℞ Hyd. Chlo. Mit.
Pv. Ipecac. āā grs. ij.
Plumb. Acetat. grs. viij.
Ft. chts. No. viij. M.
S. One every three hours.

60. Pills of sugar of lead and opium.

℞ Pv. Opii, gr. i.
Plumb. Acet. ℈i.
Ft. Pil. No. xii. M.
S. One every hour or two.

61. Collyrium.

℞ Liquor Plumb. Subacet. gtts. xii.
Vin. Opii, gtts. xl.
Aqua Rosæ, f℥viii. M.

62. Enema.

℞ Plumb. Acet. ℈i.
Tr. Opii, gtt. lx.
Aqua tepid, f℥ii. M.
S. In uterine hemorrhage.

63. Lotion.

℞ Liquor Plumb. Acet. fʒi.
Tr. Camph, f℥iii.
Aqua, Oi. M.
S. For burns, &c.

64. Kirkland's neutral cerate for burns, &c.

℞ Emplast. Plumb. ℥iv.
Ol. Oliv.
Cret. prep.
Acid. Acet. āā ℥ii.
Plumb. Acet. ʒiss. M.

Melt the oil and plaster together by a gentle fire, then add the chalk briskly; and when cool add vinegar and Acet. Plumbi, and stir till cold.

65. For hemorrhage from the stomach, uterus, &c.

℞ Plumb. Acet. grs. vi.–xii.
Aqua distil. f℥iii.
Acid. Acet. dil. fʒii.
Acet. Opii, ♏xl.
Syr. Papav. fʒv. M.
S. A tablespoonful every three hours.

66. Powder in diarrhœa.

℞ Plumb. Acet. grs. xx.
Pv. Opii, grs. x.
Bol. Armen. grs. xx.
Ft. chts. No. x. M.
S. One every four hours.

67. To be sprinkled on scrofulous ulcers.

℞ Plumb. Acet. ʒi.
Pv. Cinchon. ʒvii. M.

68. For psora.

℞ Plumb. Acet.
Flor. Croci. āā pts. ii.
Zinci Sulph. pt. i.

69.

℞ Plumb. Acet. grs. vi.
G. Camph.
Potas. Nitr. āā grs. iii.
Confect. Rosarum, q. s.
Ft. Pil. No. vi.
S. Take during the day in diarrhœa with fever.

70. Injection for gonorrhœa.

℞ Plumb. Acet, ʒi.
Alum, ʒss.
Zinci Sulph. grs. xviii.
Aqua distil. f℥vi. M.

71. Anti-phthisical German tincture.

℞ Plumb. Acet. ℥ss.
Ferri Sulph. grs. iii.
Acet. Com.
Alcohol, āā f℥ii.
Aqua Rosarum, f℥vi. M.

TONICS.

1. Compound tincture of quassia.

℞ Sem. Card. contus.
Coccus Cocti, āā ℥ss.
Pv. Cinnam.
Quassia, rasp. āā ʒvi.
Raisins, ℥vii.
Prof. Spir. Oii. M.
S. Digest for seven days, strain, add liquor, express the residue and filter. Dose, fʒi. to fʒii.

2. Compound infusion of quassia.

℞ Quassia,
Rad. Serpentaria,
Rad. Aurant. cont. āā ℥ss.
Aqua bullient. Oii. M.
S. A teacupful cold, three times a day.

3.

℞ Infus. Quassiæ, f℥iss.
Tr. Columbo, fʒi.
Ferri Muriat. ♏x. M.
S. Ft. haust. three times a day.

4.

℞ Quassia, contus. ℥ii.
Vini Alb. Oi.
Caryophyl. pv. ℈i. M.
S. A teaspoonful three or four times a day.

5. Antacid elixir.

℞ Ext. Quassia, ʒi.
Aqua Calcis, f℥viii.
S. A dessertspoonful.

6. Compound decoction of quassia.

℞ Quassia, contus. ℥i.
Anthem. Nobilis, ℥iss.
Potas. Subcarb. ʒii.
Aqua, Oiv. M.
S. Reduce to a quart by boiling. A wineglassful at a dose.

7. Compound infusion of gentian

℞ Gentian Rad. cont. ℥ss.
Cort. Aurant.
Sem. Coriand, āā ʒi.
Alcohol, diluti, f℥iv.
Aqua, f℥xii. M.
S. Pour on the alcohol first, and three hours after the water, macerate twelve hours, and strain. Dose, f℥i.

8. Compound gentian mixture.

℞ Infus. Genti. comp. ℥xii.
Infus. Sennæ, ℥vi.
Tr. Card. comp. f℥ii.
S. ℥i.–℥ii. at a dose.

9. Wine of gentian.

℞ Gent. pv. ℥ss.
Cinch. Flava, pv. ℥i.
Cort. Aurant, ʒii.
Cort. Canella, ʒi.
Proof Spirit, ℥ivss.
Sherry wine, Oi. ad ℥xvi.
S. Digest the root and barks for twenty-four hours in the spirits, add the wine, and digest seven days, strain and filter. Dose, fʒiv. to fʒviii.

10. Compound tincture of aloes and gentian. Baume de vie, or elixir of life.

℞ Aloes Socotorin. ℥i.
Pv. Zedoariæ,
Gentian,
Croci,
Rhei,
Agarici,
Syrup symp. āā ʒi. M.
S. Mix in a quart of Brandy. A tablespoonful three times a day in intermittent fever.

11. For dyspepsia.

℞ Infus. Gent. comp. f℥iii.
Aqua Cinnam. f℥i.
Sodæ Carb. ℈ii.
Rhei, pv. grs. viii.
Spts. Lavand. comp. fʒii. M.
S. A fourth part at morning and noon.

12. For the same.

℞ Pv. Rhei,
Sodæ Carb.
Ext. Gentian, āā ʒi.
Pv. Zingib. ℈i. M.
Ft. Pil. No. xl.
S. Two, three times a day.

13. For the same.

℞ Infus. Gent. comp.
Aqua Cinnam. āā f℥ii.
Sodæ Carb. ʒi.
Potas. Bitart. ℥i. M.
S. Give a tablespoonful morning and evening.

14. For leucorrhœa, &c.

℞ Ext. Gent. ʒi.
Cupri Sulph. grs. v.
Pv. Rhei, ʒss.
Syr. Simp. q. s. ut. M.
Ft. Pil. No. xx.
S. Take one or two twice a day.

15. Columbo and ginger powder.

℞ Pv. Columb.
Ferri Carb. Precip.
Rhei,
Zingiber, āā ʒi. M.
Ft. chts. No. xii.
S. One, three times a day.

16. Tonic and stomachic draught.

℞ Columb. ʒii.
Aqua fervent, f℥viii.
Digest, strain, and add
Tr. opii, ♏xxiv.
Æth. sulph. gtt. xx. M.
S. A tablespoonful, pro re nata.

17. Columbo and tartrate of iron.

℞ Columb. pv. ʒss.
Ferri Tart. ℈ij. M.
Ft. chts. No. iv.

18. For dyspepsia and chronic hepatic affections.

℞ Infus. Columb. f℥i.
Ext. Tarax. grs. x.
Sodæ Carb. grs. iv.
Tr. Card. comp. fʒi.
Aqua Pimento, f℥iii. M.
Ft. haust.
S. Three times a day.

19. Tonic pills in diarrhœa and dysentery.

℞ Pv. Columb. ℈iv.
Opii, grs. iv.
Tr. Menth. pip. gtt. x.
Syr. Caryoph. q. s.
Ft. Pil. No. xxx.
S. Take six daily.

20. Stomachic powder.

℞ Pv. Columbo, ʒi.
Succini, ʒss.
Rhei, ℈i.
Ipecac. gr. v.
Ext. cinch. ℈i.
Castor, grs. v. M.
S. Ft. Pv. Dose, grs. vi. every two hours.

21. Tonic draught, &c.

℞ Columbo, pv. ʒii.
Cinchon. decoct. ad saturan. f℥vi.
Hoff. Anodyne, fʒss.
Mel. disp. f℥i. M.
S. A teaspoonful pro re nata.

22. Compound decoction of columbo.

℞ Columbo,
Quassia, āā ʒii.
Cort. Aurant. ʒi.
Rhei, pv. ℈i.
Potas. Bicarb. ʒss.
Aqua, f℥xx. M.
Reduce to Oi. by boiling, and add
Tr. Lavand. f℥ss. M.
S. A tablespoonful every three hours

23. Tonic pills.

℞ Ext. Columbo,
Gentian,
Quassia,
Fel. Bov. inspis. āā ʒii.
Pv. Gent. q. s.
Ft. Pil. āā grs. iv.
S. One or two after dinner.

24. Decoction of cinchona.

℞ Cinchon. cort. cont. ℥i.
Aqua, Oi. M.
S. Boil for ten minutes in a covered vessel and strain.
Dose, f℥ii.

25. Infusion of cinchona.

℞ Cinch. cort. cont. ℥i.
Aqua bullient, Oi. M.
S. Macerate in a covered vessel two hours and strain. Dose, f℥ii. three or four times a day.

26. Compound infusion.

℞ Pv. Cinch. cort. ℥i.
Sulph. acid. Arom. fʒi.
Aqua, Oi. M.
S. Macerate for twelve hours and strain.
Dose, f℥ii.

27. Compound tincture.

℞ Cort. Cinch. pv. ℥ii.
Aurant. cont. ℥iss.
Serpentaria cont. ʒiii.
Saffron cont.
Red Sanders, rasp. āā ʒi.
Alc. diluti. f℥xx. M.
S. Express and filter through paper.
Dose, ʒi.–iv.

28. Cinchona and caryophyllum.

℞ Pv. Cinch.
Potas. Bicarb. āā ℥i.
Pv. Caryophylli, ʒi. M.
S. ʒss. every two hours.

29. Cinchona and serpentaria.

℞ Pv. Cinch. ℥ss.
Serpentaria, ʒi.
Sodæ Bicarb. ℈ii. M.
S. Ft. chts. No. iv. One every two hours.

30. Cinchona and camphor.

℞ Ext. Cinch. ʒi.
Pv. Opii, gr. i.
Camph. grs. xii.
Pv. Cinch. q. s. M.
Ft. Pil. No. xii.
S. One three or four times a day.

31.

℞ Ext. Cinch.
Gentian, āā ʒi.
Ferri Sulph. ʒss.
Pv. Myrrh, ʒi.
Ol. Carui. gtt. x.
Syr. Zingiber, q. s.
Ft. Pil. lx.
S. Three, three times a day.

32.

℞ Quiniæ Sulph. grs. xii.
Ammo. Carb. grs. xxiv. M.
Ft. Pil. No. xii.
S. One every hour, beginning six hours before paroxysm of fever.

33.

℞ Pv. Cinch. ℥i.
Ammo. Muriat.
Ammo. Carb. āā grs. xii.
Tart. Ant. et Potas. grs. xviii.
Syr. simp. q. s. ut.
Ft. bolus. No. xlviii.
S. One, four times a day in apyrexia.

34.

℞ Cinch. cort. pv. ℥ii.
Liquor Calcis, Oii. M.
S. A wineglassful three or four times a day.

35.

℞ Tr. Cinch.
Valerian, āā f℥i.
Card. fʒii.
Aqua menth. pip. f℥iv. M.
S. A tablespoonful every three hours.

36.

℞ Cinch. pv. ℥i.
Ant. et Potas. Tart. gr. i.
Pv. Opii. gr. i. M.
Ft. chts. No. iv.
S. One every two hours.

37. Tonic for infants.

℞ Quiniæ Sulph. grs. ii.
Acid. Sulph. Arom. ♏xvi.
Aqua distil. f℥iss.
Syr. Caryophyl. f℥ss.
S. ʒi.–ʒii., three times a day.

38. Gargle for cynanche maligna.

℞ Decoct. Cinch. f℥viss.
Acid. Hydrochlor. ff℥iss.
Mellis, f℥iss. M.

39. Enema in fevers.

℞ Cinch. Pv. ℥i.
Anth. Nobilis. ʒii.
Aqua, Oi. boil to f℥x.
Strain and add Vin. Rub. f℥ii. M.

40. Electuary.

℞ Pv. Cinch. ℥i.
Ferri Sesquiox. ʒi.
Syr. Zingiber, q. s. ut.
Ft. Elect.
S. A tablespoonful three times a day.

41. To dress hospital gangrene.

℞ Cinch. pv. ℥i.
Camph. ʒi. M.
Ft. Pulv.

42. Anti-septic fomentation.

℞ Decoct. Cinch. Oii.
Infus. Anthemis, Oi.
Tr. Camph. f℥ii.
Acid Muriat. f℥i. M.

43. To cleanse the interior of abscesses.

℞ Cinch. pv. ℥i.
Aqua, Oi.
Tr. Opii, fʒi. M.

44.

℞ Quiniæ, Sulph. grs. vi.
Morph. Sulph. grs. ss.–i.
Ft. chts. No. iv.
S. One every hour, as an anti-periodic.

45.

℞ Ext. Cinch.
Gentian, āā ʒi.
Ferri Sulph. ʒss.
Pv. Myrrh, ʒi.
Ol. Carui, gtt. x.
Syr. Zingiber, q. s. M.
Ft. Pil. lx.
S. Three, three times a day.

46.

℞ Salicin, grs. xxiv.
Muc. Acac. q. s.
Ft. Pil. No. viij.
S. One, three or four times a day.

47.

℞ Piperin. grs. xij.
Ext. Gentianæ, q. s.
Ft. Pil. No. xij.
S. One every hour in apyrexia of fever.

48.

℞ Quiniæ Sulph. grs. x.
Acid. Tannic. grs. ij.
Aqua, fʒvi.
Syr. Aurant. cort. fʒij. M.
S. A teaspoonful every two hours, (to disguise the bitter taste of the Quinia.)

49. To be sprinkled on scrofulous ulcers.

℞ Pv. Cinch. ʒviii.
Plumb. Acet. ʒi. M.

50. Tonic powder.

℞ Pv. Cinchona, ℥ss.
Pv. Serpentaria, ʒi.
Sodæ Bicarb. ℈ii. M.
Ft. chts. No. iv.
S. One every two hours.

51. Hoffmann's anti-febrifuge.

℞ Lam. Ferri, Pv. ʒi.
Pv. Cinch. ʒiss.
Hyd. chl. mit.
Sodæ Bicarb.
Potas. Sulph. āā ʒss.
Pv. Opii, gr. iss. M.
S. Ft. chts. No. vi.

52. Febrifuge of Fige.

℞ Pv. Cinch. rub. grs. iii.
Potas. Bitart. grs. iv.
Potas. Nitras. grs. x. M
S. One every four hours in a decoction of two grains of cinchona.

53. Febrifuge of Jadelot.

℞ Cinch. pv. ℥i.
Cort. Aurant.

Rad. Gentian, āā ʒii.
Ammon. Hydrochl.
Pv. Rhei, āā ʒi. M.
S. ʒi. every four hours, in a cup of water.

54. Febrifuge of Lescure.

℞ Cinch. Rub. ʒiii.
Ext. Cinch. ʒi.
Potas. Bicarb. ʒss. M.
Ft. chts. No. iv.
S. One every three hours, in a cupful of decoction of Anthemis Nobilis.

55. Quinia and camphor pills.

℞ Ext. Cinch. ʒi.
Pv. Camph. grs. xii.
Pv. Opii, gr. i.
Cinch. Pv. q. s. M.
Ft. Pil. No. xii.
S. One every three hours.

56. Tonic and stomachic pills.

℞ Aqueous Ext. Cinch. ℈i.
Ferri Subcarb. grs. xii.
Syr. Aurant. cort. q. s.
Ft. Pil. No. xii.
S. One every four hours.

57. Gargle for malignant sore throat, &c.

℞ Decoct. Cinch. ℥vi.
Acetum, ʒiii.
Mel. ℥i. M.

58. Another.

℞ Cinchon. Pv. ʒii.
Acid Hydrochl.
Mel. Rosæ. āā ʒi.
Aqua, Oi. M.

59. For scorbutic gums.

℞ Cinch. pv.
Magnes. āā ℥ss.
Cannella, Pv. ʒi
Ol. Caryophyl. gtt. i. M.

60. Gargle for angina maligna.

℞ Decoct. Cinch. f℥vi.
Pv. Camph. ℈i.
Ammon. Hydrochl. grs. xii. M.

61. Pills anti-spasmodic.

℞ Ext. Cinch.
Catechu, āā ʒii.
Assafœti. Pv.
Potas. Nit. āā ℈ii.
Musk, Pv. gr. xv. M.
S. Ft. Pil. grs. vi. each.

62. Anti-chlorotic powder.

℞ Pv. Cinch. ʒi.
Cannella, ʒss.
Lam. Ferri, Pv. ℈i.
Ft. chts. No. xii.
S. One, three times a day.

63. Wild cherry infusion.

℞ Prunus Virgin. cont. ʒss.
Aqa, Oi. M.
S. Macerate twenty-four hours and strain. Dose, f℥ii.–iii. three or four times a day.

64. Decoction.

℞ Cort. Prun. Virgin. cont. ʒi.
Aurant. cont. ℥ii.
Aqua, Oi. M.
S. Boil the bark alone for half an hour, then add the orange. A wineglassful every hour, in dyspepsia, &c.

65. Chamomile compound decoction.

℞ Anthemis Nobilis, ℥ss.
Sem. Fœnic. ʒii.
Aqua, Oi. M.
S. Boil a short time and strain.

66. Infusion of chamomile and orange peel.

℞ Flor. Anthem. Nob. ℥i.
Cort. Aurant. ℥ss.
Aqua, Oiii.
S. Macerate twenty-four hours. Dose, f℥ii., three or four times a day.

67. Serpentaria infusion.

℞ Serpentaria rad. ℥ss.
Aqua bullient. Oi. M.
S. Macerate for two hours in a covered vessel, and strain. Dose, f℥i.–℥ii., every two hours.

68. Tonic bolus.

℞ Pv. Serpentaria,
Contrayerva, āā ʒss.
Acid Succin. gtt. xi.
Syr. Aurant. q. s.
Ft. Bol. No. ii.
S. To be taken during the day.

69. Compound mixture of iron.

℞ Myrrh, ʒi.
Potas. Carb. grs. xxx.
Aqua Rosæ. f℥viiss.
Ferri Sulph. pv. ℈i.
Tr. Lavand. ℥ss.
Sacch. Alba, ʒi. M.
S. Rub the myrrh with the rose-water gradually added, then mix with them the Tr. Lavand., sugar, and Potas. Carb., and lastly the Sulphate of Iron. Pour the whole in a glass bottle, and stop well. Dose, f℥i.–℥ii., two or three times a day.

70. Pills of aloes and myrrh, or Rufus's Pills.

℞ Pv. Aloe, ℥ii.
Myrrh, pv. ℥i.
Crocus, ℥ss.
Syr. simp. q. s. M.
Ft. Pil. No. 480.
S. Take three to six pills for a dose.

71. Griffith's myrrh mixture.

℞ Gum Myrrh, ʒi.
Ferri Sulph. ℈i.
Potas. Carb. ʒi.
Sacch. Purif. ʒii.
Aquæ distil. f℥vi. M.
S. A tablespoonful, pro re nata.

72.

℞ Pv. Myrrh,
Rhei, āā ℈ii.
Aloe,
Ext. Tarax. āā ʒss.
Ol. Anthem, ♏x. M.
Ft. Pil. No. xxx.
S. Two every night, as a tonic aperient.

73. Emmenagogue powders.

℞ Myrrh Pv. ʒii.
Sagapenum,
Castorei, āā ʒi.
Ol. Menth. Pip.
Rutæ, āā, q. s.
Ft. chts. No. xxxvi.
S. One, morning and night.

74.

℞ Pv. Myrrh, ʒiss.
Ext. Hyos.
Pv. Scillæ, āā ʒss.
Aqua, q. s.
Ft. Pil. No. xxx. M.
S. Two or three daily.

75. Emmenagogue powders.

℞ G. Myrrh,
Ferri Sulph. āā ʒii.
Potas. Bicarb.
Sapo Castil. āā ʒi. M.
Ft. chts. No. x.
S. One, morning and night.

76.

℞ Sodæ Bicarb. grs. v
Pv. Myrrh,
Sabin. āā grs. vi.
Saffron, grs. iii.
Castor, grs. ii.
Ol. Succini, gtt. i. M.
Ft. chts. No. i.
S. Take in the morning.

77. Gargle.

℞ Melissa, offic. ℥ss.
Aqua bullient. q. s.
ut ft. ℥vi., decoct., then add.
Tr. Myrrh, ℥ii.
Mel. Rosarum, ℥ii. M.

78. Compound mixture of cascarilla.

℞ Infus. Cascarillæ, fʒxvii.
Acetum Scillæ, f℥i.
Tr. Camph. comp. f℥ii. M.
S. Used in chronic bronchial affections. Dose, fʒi.–℥ii., twice or thrice a day.

79. For dyspepsia with loss of appetite.

℞ Infus. Cascar. ℥vii.
Tr. Cascar.
Zingiber, āā fʒiv. M.
S. Three tablespoonfuls, three times a day.

80. Acorn Coffee, recommended by Hufeland in scrofula.

℞ Pv. Gland. Quer. torrefac, ℥i.
Aqua bullient. Oi. M.
S. Three or four teacupfuls, to be taken during the day.

81.

℞ Infus. Cascarilla, f℥iss.
Quiniæ Sulph. grs. ii.
Tr. Cascarilla,
Zingiber, āā f ʒi.
Acid Sulph. dilut. ♏viii. M.
Ft. Haust.
S. To be taken twice a day in drunkards' dyspepsia.

82. Compound infusion of orange peel.

℞ Cort. Aurant. sic. ℥ss.
Limon. ʒii.
Caryophyl. cont. ʒi.
Aqua bullient. Oi. M.
S. Macerate for a quarter of an hour in a tightly-covered vessel and strain. Dose, f℥ to ℥ii.

83. Aromatic powder.

℞ Cinnamomum, pv.
Zingiber, pv. āā ℥ii.
Card. Sem. pv.
Myristicæ, pv. āā ℥i. M.
Ft. Pv.
S. Dose, grs. x.–xxx.

84. Compound tincture of cinnamon.

℞ Cinnam. ℥i.
Sem. Card. cont. ℥ss.
Zingiber, cont. ʒiii.
Alc. diluti, Oii. M.
S. Macerate for fourteen days, express and filter through paper.
Used in spasm of stomach and flatulence, &c. Dose, ʒi.–ʒii.

85. Powder of aloes and canella—hicra-picra.

℞ Pv. aloe, ℔i.
Canella, ℥iii. M.
S Dose, grs. x.–xxx.

86. Mixture of cubebs and copaiva for gonorrhœa.

℞ Pv. Cubebæ,
Bals. Copaiv.
Muc. Gum Acac.
Tr. Opii. camph. āā f℥ss.
Sacch. alb. ʒii.
Aqua distil. f℥viii. M.
S. A tablespoonful every three hours.

87. Powders of cubebs and ergot.

℞ Pv. Cubebæ, ℥i.
Secale Cornutum, ℈ii.
Cinnam. ʒss.
Sacch. purif. ʒi. M.
Divide in chts. No. viii.
S. One, three or four times a day in leucorrhœa, &c.

88. Cubeb lozenges—vulgo, Spitta's—for coryza.

℞ Pv. Cubebæ, ℥ii.
Bals. Tolu, gr. vi.
Syr. Bals. Peru,
Ext. Glycyr. āā ℥iss.
Gum. Acaciæ, q. s. M.
S. Ft. Lozenges, āā grs. x.

89. Cubebs and bismuth.

℞ Pv. Cubebæ, ʒii.
Bismuth. subnit. ʒss.
Muc. Acac. f℥ss.
Syr. simp. f ʒvi.
Aqua distil. f℥vi. M.
S. Two tablespoonfuls three times a day in affections of the mucous membranes.

90. Anti-gonorrhœal potion.

℞ Pv. Cubebs, ʒi.
Vin. f℥ii.
Ol. Bergamot. gtt. i. M.
S. Ft. haust. Take every two hours.

91. Compound tincture of cardamom.

℞ Sem. Card. cont.
Carum. Carui. cont. āā ʒiiss.
Coccus Cacti. pv. ʒi.
Cinnam. cont. ʒv.

Raisins, ℥v.
Prof. Spirit. Oii. Imp. M.
S. Macerate fourteen days, and filter. Dose, f℥i.–℥ii.

92. Lavender compound spirit.

℞ Spt. Lavand. Oiii.
Rosemari. Oi.
Cinnam. cont. Oi.
Caryophyl. ʒii.
Myrist. ʒss.
Santalum, ʒiii. M.
S. Macerate for fourteen days, and filter through paper. Dose, gtts. xxx.–fʒi.

93. For gout, or cramps in the stomach.

℞ Pv. Zingiberis, grs. xv.
Ammo. Carb. grs. viii.
Spr. cinna. fʒii.
Aqua, f℥ss. M.
S. Ft. haust.

94.

℞ Pv. Zingiberis,
Ferri Carb. precip.
Rhei,
Columbæ, āā ʒi. M.
Ft. chts. No. xii.
S. One, three times a day.

95. Aromatic iron mixture.

℞ Pv. Cinch. ℥i.
Rad. Columb. ʒiii.
Pv. Caryoph. ʒii.
Ferri Ramenta, ℥ss.
S. Digest for three days in a close vessel, with occasional agitation, with Aqua Menth. p. q. s. ut ft. f℥xii. after filtration. Then add
Tr. Card. Comp. f℥iii.
Aurant Cort. ℥iii.
Dose, f℥i.–f℥ii.

96. Compound iron mixture.

℞ Pv. Myrrhæ, ʒi.
Potas. Carb. grs. xxv.
Aqua Rosæ, f℥viiss.
Ferri Sulph. pv. ℈i.
Spts. Lavand. ℥ss.
Sacch. purif. ʒi. M.
S. Rub the myrrh with the Rose Water gradually added, then mix with these the other ingredients, reserving the Ferri Sulph. for the last. Pour the mixture in a glass vessel, and stop closely. Dose, f℥i. –f℥ii., three times a day.

97. Compound iron pills.

℞ Pv. Myrrh, ʒii.
Sodæ Carb.
Ferri Sulph. āā ʒi.
Syrup. simp. q. s. M.
Ft. Pil. No. lxxx.
S. Dose, two to six, three times a day.

98. Iron plaster.

℞ Ferri Subcarb. ℥iii.
Emp. Plumb.
Picis Burgund. ℔ss. M.
S. Add the Iron to the Emp. Plumb. and Picis Burgund., previously mixed, and then stir them together thoroughly.

99. Pills of iron and aloes.

℞ Ferri Sulph., parts iii.
Aloes, parts ii.
Pv. Aromat. parts vi.
Confect. Rosæ, parts viii. M.
S. Pulverize the aloes and iron separately, mix the whole ingredients in a proper mass, then make Pil. grs. v. each. Dose, i.–iii.

100. Sulphate of iron pills.

℞ Ferri Sulph. Exsic. parts ii.
Ext. Tarax. parts v.
Confect. Rosæ, parts ii.
Pv. Glycyrrhiza, parts iii. M.
Ft. Pil. grs. v. each.
S. Dose, grs. v.–xx.

101. Pills of iron by hydrogen.

℞ Ferri Pulveris, grs. c.
Ft. Pil. No. L.
S. One, three times a day, half an hour after each meal. Excellent in chlorosis and anemia.

102.

℞ Ferri Pulveris, grs. c.
Quinia Sulph. grs. vii.
Pv. Caprici, grs. vi.
Ext. Ignatia Amara, grs. vi. M.
Ft. Pil. No. L.

S. Dose as above, in similar cases, with a weak digestion and great nervous irritability.

103.

℞ Pil. Ferri Carb. ʒi.
Ferri Subcarb. q. s. M.
Ft. Pil. No. xx.
S. One, morning and night.

104.

℞ Potas. Iodi.
Manganes. Sulph. exsicc. āā ʒi.
Mellis. q. s. M.
Ft. Pil. No. xxx.
S. Keep the bottle tightly corked; one pill night and morning. Used as the preparations of iron.

105.

℞ Liq. Ferri Nitrat. fʒi.
Syr. fʒi.
Aqua, fʒvi. M.
S. A teaspoonful every three hours. Excellent in chronic mucous diarrhœa, hemorrhage from the bowels, &c.

106. Pills of myrrh and sulphate of iron.

℞ Ferri Sulph.
Gum Myrrh, āā ℈ii.
Potas. Carb.
Sapon. purif. āā ʒss. M.
Ft. Pil. No. xl.
S. Dose, two, morning, noon, and night, in suppression of the menses.

107. Hooper's pills.

℞ Ferri Sulph. ℈i.
Pv. Sennæ,
Jalap,
Potas. Bitart. āā ℈ss.
Zingiber, grs. xii.
Syr. simp. q. s. ut ft.
Pil. No. xxv.
S. Take three, twice a day, followed by gtts. xx. of Tr. Ferri muriat. in bitter infusion.

108. Mixture of muriate of iron.

℞ Tr. Ferri Muriat.
Aloe comp. āā f℥ss.
Castorei, fʒii. M.
S. A teaspoonful three times a day, in a wineglassful of chamomile tea.

109. Powder of tartrate of iron and columbo.

℞ Ferri Tart. ℈ii.
Pv. Columb. ʒss. M.
Ft. Pulv. No. iv.
S. One every three hours in syrup.

110. Powder of prussiate of iron and guaiacum.

℞ Ferri Ferrocyanur.
Pv. Guaiac. āā ℥i. M.
Ft. chts. No. xii.
S. One, three times a day, in obstinate intermittent.

111. Pills of ammoniated iron.

℞ Ferri Ammon. ℈i.
Pv. Rhei, grs. viii.
Confect. Rosæ, q. s. ut ft.
Pil. No. v. M.
S. One pill a day for a fortnight, and then omit for the same time, and again resume. In Rachitis.

112. Solution of hydriodate of iron.

℞ Ferri Iod. ʒi.
Aquæ distil. f℥i. M.
Ft. solution.
S. Dose, gtts. vi.–x., morning, noon, and night, in cold water.

113. Pills of bromide of iron.

℞ Brom. Ferri pulv. grs. xii.
Confect. Rosæ, grs. xviii.
Gum Acac. grs. xii. M.
Ft. Pil. No. xx.
S. Dose, two in the morning, and two in the evening, in hypertrophy of the heart and scrofulous affections.

114. Pills of arseniate of iron.

℞ Ferri Protox. Arsen. grs. iii.
Ext. Humuli, ʒii.
Pv. Althææ, ʒss.
Syr. simp. q. s. ut ft.
Pil. No. xlviii
S. One a day in scrofulous, cancerous, and herpetic affections.

115. Pills in chlorosis, &c.

℞ Ferri Sulph. ʒi.
Potas. Carb. grs. vi.
Pv. Myrrhæ, ʒi.
Aloe, ʒss. M.
Ft. Pil. No. xxx.
S. Dose, three, twice a day.

116. Donovan's formula for protox ferri.

℞ Ferri Sulph. pv. ℥ss.
Magnes. Calc. ℈ii.
Aqua, f℥vi.
Tr. Quassiæ, fʒii. M.
S. Rub the magnesia with very little water, and when mixed, add the remainder; then add the sulphate and tincture, rub up again for awhile, and then rapidly divide in six phials, immediately cork and seal. Take one, night and morning.

117. Emmenagogue powder.

℞ Ferri Lam. grs. xviii.
Aloe spic. grs. vi.
Magnes. Calc. ʒiss. M.
Ft. chts. No. iii.
S. One, every four hours.

118. Pills of arseniate of iron in cancerous affections, &c.

℞ Ferri Arsen. grs. iii.
Ext. Humuli, ʒi.
Pv. Malvæ, ʒss.
Syr. Aurant. q. s. M.
Ft. Pil. No. xlviii.
S. One, daily.

119. In scrofula, &c.

℞ Ferri Sesquiox.
Ext. Conii, āā ʒi. M.
Ft. Pil. No. xxiv.
S. Take two, twice a day.

120.

℞ Ferri Sulph. Exsic. ℈i.
Pv. Aloe, ℈ii.
Caryoph. grs. v.
Terebin. Ven. q. s. M.
Ft. Pil. No. xx.
S. One, thrice a day.

121. Emmenagogue pills.

℞ Ferri Sulph. ℈i.
Pv. Aloe, grs. xx.
Sap. Castil. grs. xx. M.
Ft. Pil. No. x.
S. One, morning and night.

122. Anti-herpetic liniment

℞ Ferri Carburet. ℥ss.
Flos. Zinci, ʒi.
Adeps, ℥i. M.

123. Compound iron bolus

℞ Ferri Ox. Nigri.
Anthem. Nob. āā ℥ss.
Myrrh,
Castor, āā grs. v.
Syr. simp. q. s. M.
S. Take at once.

124. Compound sulphate of iron pills.

℞ Ferri Sulph. ℥i.
Ext. Anthem. ℥iss.
Ol. Menth. Pip. fʒi.
Syr. simp. q. s. M.
S. Dose, grs. v.–x.

125. Emmenagogue pills.

℞ Ferri Sulph. ʒss.
Galbanum,
Myrrh, āā ʒiss.
Syr. Aurant. Cort. q. s. M
Ft. Pil. āā grs. ii.
S. Six or more, every three hours.

126. Compound wine of iron.

℞ Lam. Ferri, ℥i.
Gentian, ℥ss.
Canella Alb. ʒii.
Vin. Alb. f℥xii. M.
S. Decant after digesting three days.

127. Subacetate of copper ointment.

℞ Cupri Subacet. pv. ʒi.
Cerat. simp. ʒxv. M.
S. Apply in porrigo, in scrofulous affections of the eyelids, &c.

128. Pills of ammoniated copper.

℞ Cupri Ammon. pv. parts i.
Panis, pts. vi.
Sol. Ammon. Carb. q. s. M.

S. Mix well, and make in pills, each containing gr. ss. of copper. Dose, one pill night and morning, gradually increased.

129. Emetic powder.

℞ Cupri Sulph.
Tart. Ant. et Potas. āā ℥i.
Sacch. Aloe, grs. x. M.
S. A violent emetic, and to be used only when all others fail.

130. Emetic pills.

℞ Cupri Sulph.
Pv. Ipecac. āā ʒi.
Syr. simp. q. s. M.
Ft. Pil. āā grs. v.
S. Dose, two every quarter of an hour, till emesis is produced.

131. Solution of sulphate of copper and camphor.

℞ Cupri Sulph. ℥ss.
Camph. ʒii.
Aqua bullient. Oiv. M.
S. Use as a collyrium, &c.

132. Pills of ammoniuret of copper and ext. quassia.

℞ Cupri Ammon. ʒss.
Ext. Quassia, ʒiss. M.
Ft. Pil. No. xxx.
S. One, three times a day, in nervous affections.

133. For gonorrhœa.

℞ Cupri Ammon. grs. v.
Aqua Rosæ, f℥viii. M.
S. Ft. injection.

134. For the same.

℞ Cupri Sulph. grs. vi.
Aquæ distil. f℥vi.
Tr. Opii, fʒi. M.
S Ft. injection.

135. Pills of sulphate of copper.

℞ Cupri Sulph. grs. iv.
Ext. Cinch. grs. xxxii.
Syr. simp. q. s. M.
Ft. Pil. No. xvi.
S. One, four times a day in obstinate intermittents.

136. Pills of oxide of zinc.

℞ Oxidi Zinci, ℈ii.
Conserv. Rosarum, q. s.
ut ft. Pil. No. x.
S. One, three or four times a day, in epilepsy and chorea.

137. Lotion of lime-water and zinc.

℞ Zinci Oxidi, grs. xii.
Cupri Sulph. grs. iii.–iv.
Mel. Rosæ, ʒi.
Aquæ Calc. f℥ii. M.
Ft. Lotio.
S. To be applied to phagedenic ulcers of the genitals.

138. Injection of sulphate of zinc in gonorrhœa.

℞ Zinci Sulph. grs. x.
Pv. Acac. ʒii.
Tr. Opii, fʒi.
Aquæ distil. f℥viii.

139. In epilepsy, neuralgia, and general nervous irritability.

℞ Zinci Valeriana, grs. xviii.
Ft. Pil. No. xii.
S. One, three times a day.

140.

℞ Zinci Chlori. grs. iii.
Aqua f℥i. M.
S. Injection for gonorrhœa, three times a day.

141. Collyrium of acetate of zinc.

℞ Zinci Sulph.
Acet. Plumb. āā grs. vi.
Aqua Rosarum, f℥iv. M.

142. Ointment of iodide of zinc.

℞ Zinci Iod. ʒi.
Axung. ℥i. M.
Ft. Ungt.
S. A drachm to be rubbed on glandular swellings, &c.

143. In spasmodic cough.

℞ Zinci Ox. grs. iii.
Sacch. Alb. grs. v. M.
Ft. chts. No. iv.
S. One to be taken every hour.

144. For neuralgia.

℞ Zinci Ox.
Ext. Hyosci.
Hellebor. Nig. āā ʒi.
Pv. Glycyrrh. rad. q. s.
Ft. Pil. lxxii.
S. Dose, one-half of a pill or a pill daily.

145. For spasmodic coughs.

℞ Zinci Sulph. grs. x.
Pv. Myrrhæ, ʒiss.
Conserv. Rosæ, q. s. ut.
Ft. Pil. No. xx.
S. One to be taken twice a day.

146. Pomade in scrofulous ophthalmia.

℞ Zinci Ox. grs. xv.
Hyd. Chl. Mit. grs. xii.
Camph. grs. viii.
Butyri recentis, ʒii.
Catechu, ʒss. M.
S. A piece about the size of a pin's head should be applied to the eyelids every second or third night, at bed-time.

147. For affections of the mucous membranes of the bowels, bladder, &c.

℞ Bismuth, Subnit. ʒss.
Pv. Cubebarum, ʒii.
Muc. Acac, f℥ss.
Syr. simp. fʒvi.
Aquæ distil. f℥vi. M.
S. Two tablespoonfuls, three times a day.

148. In dyspepsia.

R Bismuth, Subnit. ʒi.
Muc. Acac. q. s. ut.
Ft. Pil. No. xxx.
S. One every two hours.

149. Sedative powder.

℞ Bismuth, Subnit. grs. vi.
Magnesia,
Sacch. Alb. āā grs. xl. M.
Ft. chts. No. iv.
S. One every hour.

150. In chorea and epilepsy.

℞ Argent. Nit. grs. iii.
Pv. Opii, ʒss.
Camph.
Mucis. Moschatæ, āā ℈i.
Muc. Acac. q. s. ut.
Ft. Pil. No. xiv.
S. One, morning and night.

151. Pills of nitrate of silver.

℞ Argent. Nit. grs. ii.–iii.
Micæ panis, ʒss.
Aquæ font. q. s. ut.
Ft. Pil. No. xii. M.
S. One, night and morning.

152. Collyrium in acute ophthalmia, &c.

℞ Argent. Nit. grs. i.–ii.
Aquæ distil. f℥ii. M.
Ft. Solutio.

153.

℞ Argent. Nit. grs. iii.
Pv. Opii, ʒss.
Moschi, ℈i.
Camph. ℈ii. M.
Ft. Pil. No. xlviii.
S. Take two or three in a day.

154.

℞ Argent. Nit. grs. ii.
Ext. Humuli, ℈i.
Ext. Hyos. grs. xii. M.
Ft. Pil. No. viii.
S. One, three times a day.

155. Sulphuric acid mixture.

℞ Acid Sulph. gtt. x.
Ferri Sulph. grs. ii.
Sacch. Alb. ʒi.
Aquæ distil. f℥iv. M.
S. A teaspoonful, to be repeated every two, three, or four hours.

156. Detersive gargle.

℞ Acid Sulph. gtt. x.
Mel Rosæ, f℥ii.
Decoct. hordei, f℥vi. M.

157. Astringent gargle.

℞ Rosæ Gallic.
Gallarum,
Cort. Granati, āā ℥i.
Decoct. hordei.
Vin. Rub. āā f℥iv.
Mel. Rosæ, f℥ii.
Acid Sulph., ad gratum acidum. M.

158. In lues venerea.

℞ Acid Nit. fʒi.
Aquæ distil. Oii.
Sacch. Alb. ℥i. M.
S. One-fourth or one-half daily.

159. Nitric acid mixture.

℞ Acid Nit. fʒiss.
Pv. Acac.
Sacch. Alb. āā ʒiii.
Aquæ distil. f℥vi. M.
S. A tablespoonful, pro re nata.

160. Camphor, laudanum, and nitric acid, or Hope's camphor mixture, for diarrhœa and dysentery.

℞ Aqua Camph. f℥iv.
Acid Nit. gtts. iv.
Tr. Opii, gtts. xl.–lx. M.
S. A tablespoonful every two hours.

161. Muriatic acid in barley water.

℞ Acid Muriat. gtts. xxx.
Decoct. hordei. f℥viii. M.
S. One ounce, three times a day.

162. Linctus with muriatic acid.

℞ Acid Muriat. fʒi.
Mel.
Aquæ Rosarum, āā f℥i. M.
S. For scorbutic gums, to be applied three or four times a day.

163. In hepatic affections.

℞ Acid Nit. fʒi.
Muriat. fʒss.
Aquæ distil. f℥viii. M.
Add
Sulph. Æth. Nit. fʒi.–fʒii. M.
S. Twenty drops every three hours, in a wineglassful of sweetened water.

ARTERIAL, CEREBRAL, AND NERVOUS STIMULANTS, &c.

1.

℞ Spts. Ammon. Arom.
Lavand. Comp. āā f℥i. M.
S. A small teaspoonful in water when languor or flatulence is present.

2. In flatulence, &c.

℞ Mist. Camph. f℥i.
Spts. Ammon. Arom. ♏xxx.
Lavand. Comp.
Syr. simp. āā fʒi. M.
Ft. haust.

3. In diarrhœa and flatulence in young children.

℞ Magnes. ℈i.
Ol. Carui, ♏iv.
Spts. Ammon. Fœtid. ♏xx.
Tr. Opii, ♏v.
Syr. simp. fʒss.
Aquæ Menth. Pip. f℥iss. M.
S. A teaspoonful, every four hours.

4. A substitute for Dalby's carminative in the colic of infants.

℞ Aquæ Anethi, f℥ii.
Magnes. ʒss.
Tr. Opii, ♏ii–iv.
Ol. Anethi, ♏ii.
Sacch. Alb. ℈ii.
Arom. Confect. grs. x. M.
S. A teaspoonful, three times a day.

5. In nausea and flatulence.

℞ Magnes. Carb. ʒiss.
Spts. Æth. Sulph. Comp. f ʒiii.
Tr. Card. Comp. f ℥ss.
Anisi. f ʒv.
Ol. Carni, ♏viii.
Syr. Zing. f ʒii.
Mist. Camph. f ℥iss.
Aquæ Menth. Virid. f ℥v. M.
S. Two tablespoonfuls, pro re nata.

6. In nervous headache.

℞ Ammon. Carb. grs. x.
Valer. pv. ℈i.
Aquæ Cinnam. f ℥ii. M.
S. Ft. haustus.

7. In nausea and vomiting.

℞ Sodæ Bicarb. grs. xx.
Syr. Aurant. f ʒi.
Aquæ, f ℥iss. M.
Ft. haust.
S. To be taken with half an ounce of lemon-juice.

8. In chronic rheumatism.

℞ Ol. Terebinth. rect. f ℥i.
Vitel. ovi. unius., tere simul et adde gradatim.
Mist. Amyg. f ℥iv.
Syr. Aurant. f ℥ii.
Tr. Lavand. Comp. f ʒiv.
Ol. Cinnam. ♏iv. M.
S. Two tablespoonfuls, three times a day.

9.

℞ Ol. Terebinth. f ʒii.
Pv. Caps. grs. v.
Mellis, f ℥iv.
Pv. Rad. Glycyr. q. s. ft. Electuary.
S. A tablespoonful, three times a day.

10. A gargle in cynanche tonsillaris.

℞ Tr. Capsici, f ʒiv.–viii.
Aqua Rosæ, f ℥vii.
Syr. Ros. Gall, q. s. M.

11. For the same.

℞ Pv. Capsici, ʒii.
Sodii Chlor. ʒi.
Aqua bullient. f ℥vi. M.
S. Let it stand half an hour, strain, and add to the strained liquor six ounces of vinegar.

12. For angina gangrenosa: a gargle.

℞ Liquor Sodæ, Chlor. (Labarraquii), f ℥iss.
Aqua distil. f ℥vi.
Mellis, f ℥ss. M.

13. Anodyne mixture.

℞ Tr. Opii, ♏xxv.
Spts. Æth. Sulph. ♏xxx.
Syr. Tolu, f ʒiss.
Mist. Camph. ℥i. M.
S. Ft. haustus.

14. To procure sleep.

℞ Opii. Ext. Aqu. gr. i.
Pil. Galbani Comp. grs. vi. M
S. A pill to be taken at bed-time.

15. For the same.

℞ Ext. Opii, Aqu. gr. ii.
Camph. grs. ii.
Syr. simp. q. s. ut.
Ft. Pil. No. i.
S. To be taken at bed-time.

16. For the same.

℞ Acet. Opii, ♏x.
Mist. Camph. f ℥i.
Ft. haustus.
S. To be taken at bed-time.

17. Enema in dysentery.

℞ Tr. Opii, ♏xl.
Muc. Amyli. f ℥iv. M.

18. To allay pain, &c.

℞ Morph. Acet. gr. i.
Aqua distil. f ℥i. M.
S. A teaspoonful at bed-time; or, when pain is urgent, every six hours.

19. In cancer, and other painful affections, &c.

℞ Ext. Conii, ʒss.
Pv. fol. Conii, grs. xv. M
Ft. Pil. No. xv.
S. One, three times a day.

20. In the same.

℞ Ext. conii, ℈i.
Pv. Ipecac. comp. ʒss.
Ft. Pil. No. x.
S. One, every three hours.

21. In nervous irritability.

℞ Ext. Hyos. grs. xii.
Camph. grs. vi.
Spts. rectif. ♏ii. M.
Ft. Pil. No. vi.
S. Two, every night.

22. For the same.

℞ Ext. Hyos. grs. iii.
Conii, grs. ii. M.
Ft. Pil. No. i.
S. To be taken at bed-time.

23. In asthma, and other spasmodic affections.

℞ Ext. Stram. gr. i.
Glycyrrh. grs. vii. M.
Ft. Pil. No. iv.
S. Two, night and morning.

24. In nervous and spasmodic affections.

℞ Mist. Assafœt. fʒvss.
Tr. Valer. Ammon. fʒiv. M.
S. One fourth, every four hours.

25. For the same.

℞ Mist. Camph. f℥v.
Spts. Ammon. fœtid, fʒv.
Syr. Croci. fʒiii. M.
S. Two tablespoonfuls for a dose.

26. For the same.

℞ Mist. Camph. fʒx.
Tr. Opii, ♏xl.
Spts. Æth. Sulph. fʒi.
Syr. Rhœados. fʒi. M.
S. Ft. haustus.

27. In hysteria, nervous headache, &c.

℞ Pv. Valer. Rad. ℈i.
Cinnam. Comp. grs. x. M.
S A powder to be taken every four hours.

28.

℞ Quiniæ Valerian. *Dub.* grs. xii
Pv. Tragac. grs. vi.
Aqua, q. s. ft. mas.
Ft. Pil. No. viii.
S. One every hour or two in hemicrania.

29. For violent pain and spasm, especially in cholera asphyxia.

℞ Chloroform, fʒii.
Morph. Acet. grs. ii.
Gum Acac.
Sacch. Alb. āā ʒss.
Aqua Camph. q. s. ft. f℥ii. M.
S. A teaspoonful every hour or two, or more frequently if pain is severe. It has also a tendency to relieve vomiting.

30. In asthma.

℞ Pv. Opii. gr. i.
Castorei, grs. ix.
Digit. grs. ii.
Pil. Scillæ Comp. grs. viii. M.
Ft. Pil. No. iv.
S. One, three times a day.

31. In hysteria.

℞ Tr. Assafœt. fʒii.
Tr. Castor.
Moschi, āā fʒi.
Opii, ♏xxx. M.
S. ♏xxx. in an ounce of mint water, every two hours.

32. For the same.

℞ Assafœt. ʒi.
Aq. Menth. pip. f℥vss. M.
Add,
Tr. Valer. Ammon. fʒii.
Castor. fʒiii.
Æth. Sulph. fʒi. M.
S. A tablespoonful every two hours.

33. In epilepsy.

℞ Pv. Moschi. ʒi.
Ox. Zinci, ʒss.
Ext. Valer. q. s. ut. ft.
Pil. No. xxx.
S. Three pills, three times a day.

34 In convulsive affections.

℞ Mist. Moschi, ℥vi.
Spts. Ammon. Arom. f ʒii.
Tr. Castor. f ʒiv.
Syr. Papav. f ʒii. M.
S. Three tablespoonfuls, every four hours.

35. In gout of the stomach.

℞ Ammon. Carbon.
Pv. Capsici,
Caryoph.
Macis, āā ℈i.
Ol. Carui. gtt. v.
Ext. Gentian, grs. xii.
Syr. simp. q. s. M.
Ft. Pil. No. xx.
S. One, every two hours.

36. In the same.

℞ Pv. Zingib. grs. xv.
Ammon. Carb. grs. viii.
Spts. Cinnam. f ʒii.
Aqua, f ℥iss. M.
S. To be taken at once.

37. Camphor mixture.

℞ Camphoræ, ʒi.
Pv. Gum Acac.
Sacch. Alb. āā ʒiss.
Tr. Opii, gtts. xl.
Aqua Menth, f ℥iv. M.
S. A tablespoonful, every two hours.

38. Camphor and myrrh.

℞ Camph. pv. ʒi.
Pv. Gum Myrrh. ʒss.
Sacch. alb. ʒii.
Aqua distil. f ℥vi. M.
S. A tablespoonful, every two hours.

39. Mixture of oil of turpentine in low forms of fever.

℞ Ol. Terebinth. gtt. cxx.
Pv. Gum Acac.
Sacch. Alb. āā ʒii.
Tr. Opii, gtts. lx.
Lavand. Comp. f ʒii.
Aqua Menth. Sativ. f ℥v. M.
S. A tablespoonful, every two hours.

40. Emulsion of phosphorus.

℞ Phosphor. Puri. grs. ii.
Muc. Acac. q. s.
Let these articles be carefully triturated in a mortar, and gradually add as much distilled water as will make an emulsion of ℥vi., then add
Syr. simp. f ℥i.
Liquor Hoffmann Mineralis, gtt. xxx. M.
S. A tablespoonful, every two hours.

41. Pills of lactucarium, to procure sleep, &c.

℞ Lactucarii Ext. grs. xii.
Ft. Pil. No. vi.
S. One, every two hours till sleep is procured.

42. Gargle in cynanche maligna, &c.

℞ Pulv. Capsici, ʒi.
Sodæ Chlor. ℈i.
Acetum, f ʒiv.
Aqua bullient. f ℥vi. M.

43. In obstinate hiccup.

℞ Ol. Succini, gtts. lx.
Sacch. Alb. ʒii.
Muc. Acac. f ℥vi. M.
S. A tablespoonful, four times a day.

44. A liniment in rheumatic pains, &c.

℞ Ol. Succini, f ℥i.
Tr. Opii, f ℥ss.

45. A liniment.

℞ Chloroform, f ʒii.
Tinct. Aconiti, f ʒi.
Tinct. Opii, f ℥ss.
Tinct. Camph. q. s. ft. f ℥iii.
S. Bathe the part affected; but be cautious that it is not too long or closely applied to one spot, or it may vesicate.

ARTERIAL AND NERVOUS SEDATIVES.

1. In fevers.

℞ Ox. Antim. cum Phosphat. Calcis, ℥i.
Ft. chts. No. vi.
S. One, every two or three hours, in syrup or molasses.

2. Pills of antimonial powder and calomel, in acute rheumatism.

℞ Pv. Antimon. grs. x.
Opii, pv.
Hyd. Chl. Mit. āā grs. ii.
Confect. Rosæ, q. s. M.
Ft. Pil. No. iv.
S. Two, at bed time.

3.

℞ Ant. et Potas. Tart. grs. ii.
Pv. Opii, grs. vi.
Camph. grs. xxxvi.
Spts. Rectif. gtts. iii.
Conserv. Rosarum, q. s.
Ft. Pil. No. xii.
S. One, every fourth hour.

4. In fevers.

℞ Ant. et Potas. Tart. gr. i.
Potas. Nit. pv. ℥i.
Hyd. Chl. Mit. grs. vi. M
Ft. chts. No. vi.
S. One, every two hours in syrup.

5. In fevers and rheumatism, &c.

℞ Potas. Nit. grs. xv.
Pv. Acac. grs. x.
Mist. Amyg. f℥ii. M.
S. A draught every four hours.

6. In inflammatory diseases.

℞ Potas. Nit. grs. v.
Liq. Ammon. Acet. f℥ii.
Aqua Menth. pip. f℥v.
Ant. et Potas. Tart. Vin. ♏xx.
Muc. Acac. Syr. āā f℥i. M.
S A draught every fourth hour.

7. For the same.

℞ Ant. et Potas. Tart. gr. ss.
Hyd. Chl. Mit. grs. iv.
Opii, grs. ii.
Confect. Rosæ, q. s. M.
Ft. Pil. No. ii.
S. One, at bed time.

8. For the same.

℞ Potassæ Nit. grs. viii.
Tr. Digitalis, gtts. xvi.
Infus. Rosæ, f℥xiii.
Syr. Rosæ, f℥i. M.
Ft. haust.
S. Twice a day.

9. Emetics.

℞ Pv. Ipecac. ℈i.
Tart. ant. et potas. gr. i. M.
S. To be taken at once, and followed with a draught of warm water.

10. Powder of sulphate of copper.

℞ Cupri. Sulph. grs. ii.–iv.
S. Take in syrup, and follow with a draught of warm water.

11. Powder of sulphate of zinc.

℞ Zinci Sulph. grs. x.–℥ss.
S. Take as the preceding.

12. Solution of tartrate of antimony and potassa.

℞ Ant. et Potas. Tart. grs. vi.
Sacch. Alb. ℥i.
Aqua distil. f℥iv. M.
S. A small wineglassful every ten or fifteen minutes till it operates.

13. Infusion of lobelia.

℞ Lobeliæ fol. ℥i.
Aqua bullient. Oi. M.
S. A small wineglassful every half hour till it operates.

14. For young infants.

℞ Vin. Ipecac. f℥ss.
Syr. simp. f℥ss.
Aqua, f℥i. M.

S. A teaspoonful every fifteen minutes till it operates.

15. For infants with croup.

℞ Aquæ distil. f℥i.
Vin. Ipecac. f℥ss.
Liq. Ant. et Potas. Tart. fʒii.
Syr. Scillæ, fʒii. M.

S. A teaspoonful frequently till vomiting is produced.

16. Mustard draught.

℞ Pv. Sinapis, ʒi.
Aqua tepid. Oss. M.
S. A tablespoonful every twenty minutes.

CATHARTICS.

1.

℞ Hyd. Chl. Mit. grs. ii.
Pv. Scam. grs. iii.
Sacch. Alb. grs. ii.
Pv. Zingib. grs. ii. M.

2. For worms and morbid state of the intestinal secretions.

℞ Hyd. Chl. Mit. grs. iii.
Pv. Scam. Comp. grs. x. M.
S. Take this twice a week.

3. For the same.

℞ Pv. Jalap. grs. x.
Rhei, grs. v.
Hyd. Chl. Mit. grs. iii.
Pv. Cinnam. Comp. grs. ii. M.

4. To produce a free evacuation from the bowels.

℞ Infus. Sennæ Comp. f℥v.
Potas. Tart. ℥i.
Tr. Sennæ,
Jalap, āā fʒiv.
Syr. Rhamni, fʒiii. M.
S. Take one-fourth part at once, and repeat the dose every fifteen minutes till it operates.

5. In gout.

℞ Vin. Colch. Sem. f℥ss.
Magnes. Carb. ʒi.
Aqua Cinnam. f℥iii. M.
S. A tablespoonful every three hours.

6.

℞ Vin. Rad. Colch. recent. fʒii.
Magnes. Carb. ʒi.
Aqua Cinnam. f℥iii. M.
S. A teaspoonful every three hours.

7. Pills of croton oil.

℞ Ol. Tiglii, ♍ii.
Micæ panis, grs. viii. M.
Ft. Pil. No. ii.
S. One immediately, and repeat in six hours if necessary.

8. In obstinate costiveness.

℞ Hyd. Chl. Mit. grs. xii.
Pil. Gambog. Comp.
Ext. Colo. Comp. āā grs. xv.
Syr. Zing. q. s. ut
Ft. Pil. No. xii.
S. Two at bed-time, pro re nata.

9. In anasarca.

℞ Elaterium Ext. gr. i.
Pv. Zing. ℈ss.
Ol. Junip. ♍ii
Syr. Rhamni, q. s. ut
Ft. bolus.
S. Take at once.

10. For the same.

℞ Ext. Elateri, gr. i.
Hyd. Chl. Mit. grs. xii.
Pv. Zing. ʒss.
Sacch. Alb. ℈ii. M.
Ft. chts. No. xii.
S. One, three times a day.

11. A mild purgative.

℞ Hyd. Mass. ℈i.
Ext. Colo. Comp. ʒss. M.
Ft. Pil. No. x.
S. Take one every other night.

12. In habitual constipation.

℞ Pv. Rhei,
Jalap. āā grs. v.
Hyd. Chl. Mit. grs. ii. M.
S. Take at bed-time, and follow the next morning with three tablespoonfuls of the preparation, and repeat every three hours till it operates.

13.

℞ Infus. Sennæ Comp. f℥iv.
Magnes. Sulph. ℥i.
Tr. Sennæ,
Jalap.
Syr. Zing. āā f℥iii. M.

14. For the same.

℞ Ext. Colo. Comp. ʒss.
Pil. Aloe et Myrrha, ℈ii. M.
Ft. Pil. No. xvi.
S. Two, pro re nata.

15. Tonic aperient in chlorosis, anæmia, &c.

℞ Pv. Aloe, ℈ii.
Myrrhæ, ʒi.
Ext. Gent.
Ferri Sulph. āā ʒss. M.
Ft. Pil. No. xxxvi.
S. Two, night and morning.

16. In nervous irritability.

℞ Ext. Colo. Comp. grs. xvi.
Hyd. Mass. grs. vi.
Ext. Hyos. grs. viii.
Pv. Capsici, grs. ii. M.
Ft. Pil. No. vi.
S. One or two at bed-time, pro re nata.

17. Aperient and stomachic.

℞ Infus. Sennæ Comp. f℥iii.
Infus. Gent. Comp. f℥iiss.
Liq. Potass. fʒi.
Tr. Card. Comp. fʒiiss. M.
S. Take two tablespoonfuls three times a day.

18. In the diarrhœa of infants.

℞ Pv. Rhei, grs. xii.
Hyd. Cum Creta, grs. vi.
Pv. Arom. grs. ii. M.
Ft. chts. No. vi.
S. One every three hours.

19. A gentle aperient for hemorrhoids.

℞ Sennæ Confect. ℥i.
Sulph. loti, ʒiv.
Syr. Tolu. q. s. ut ft.
Electuary. Two or three spoonfuls in the morning, and repeat the dose every three hours till it operates.

20. For the same.

℞ Potas. Bitart. ℥ss.
Sulph. ℥i.
Piper Nigri Confect. ʒii.
Ol. Carui, ♏vi.
Theriaceæ, ℥iii.
S. One teaspoonful twice a day.

21. Griffitt's cathartic pills.

℞ Pv. Jalap.
Rhei,
Sapon. Alb. āā ʒss.
Hyd. Chl. Mit. grs. xxv.
Ant. et Potas. Tart. gr. iss.
Aqua distil. q. s. ut
Ft. Pil. No. xxv.
S. Take two at once, and repeat in two hours if necessary.

22. Pills of blue mass and soda.

℞ Hyd. Mass. grs. ix.
Pv. Rhei,
Sodæ Bicarb. āā grs. xii.
Syr. Rhei Arom. qs. ut
Ft. Pil. No. xii.
S. One, twice or thrice a day, in derangement of the liver.

23. In habitual costiveness

℞ Pv. Rhei.
Aloe, āā ʒss.
Sap. Alb. qs. ut
Ft. Pil. No. xxv.
S. Three or four, occasionally.

24. Oleaginous mixture.

℞ Ol. Ricini, f℥iss.
Pv. Gum Acac. ʒii.
Sacch. Alb. ʒi. M.

Adde Aqua Menth. Sativ. f℥iv.
Tr. Opii, gtts. xl.–l. M.
S. A tablespoonful every hour or two.

25. Magnesia and assafœtida mixture for infants.

℞ Magnes. Carb. ʒss.
Tr. Assafœt. gtt. lx.
Opii, gtt. xx.
Sacch. Alb. ʒi.
Aqua distil. f℥i. M.
S. Twenty-five drops to an infant from two to four weeks old, in flatulent colic, and diarrhœa.

26. Abernethy's infusion, and tincture of senna.

℞ Infus. Sennæ, fʒvi.
Tr. Sennæ, fʒii.
Mannæ, ʒii.
Magnes. Sulph. ℥ss.
Aqua Menth. Sativ.
Aqua distil. āā f℥iss.
S. One half for a dose, and repeated if necessary.

27. Scuddamore's mixture of colchicum and Epsom salts, for gout.

℞ Magnes. Sulph. ℥i.–℥ii.
Aqua Menth fʒx.
Acet. Colch. f℥i.–f℥iss.
Syr. Croci, f℥i.
Magnes. ℈viii. M.
S. One, two, or three tablespoonfuls, repeated every two hours, until four or six evacuations are produced in twenty-four hours.

DIURETICS.

1. In dropsy

℞ Potas. Nit. grs. x.
Bitart. grs. xv.
Pv. Acac. grs. x.
Sacch. Alb. ʒss. M.
S. Take every fourth hour in a cupful of warm decoction of barley.

2.

℞ Infus. Cascar. f℥vi.
Spts. Junip.
Æth. Nit. Comp. āā f℥i.
Confect. Arom. ʒiss. M.
S. Take two tablespoonfuls three times a day.

3.

℞ Potas Bitart. ʒi.
Pv. Scillæ, grs. ii.
Cinnam. Comp. grs. iv.
Sacch. Alb. ʒss. M.
S. Take three times a day.

4.

℞ Scillæ Rad. Exsic. grs. xii.
Potas. Nit. ʒi.
Sacch. Alb. ʒi.
Pv. Cinnam. Comp. ʒss. M.
Ft. chts. No. vi.
S. One, twice a day.

5. In ascites and anasarca.

℞ Mass. Hydrarg. ʒi.
Pv. Scillæ, ℈i.
Opii, grs. v.
Confect. Rosæ. M.
Ft. Pil. No. xx.
S. One, three times a day.

6.

℞ Pv. Digital.
Scillæ, āā gr. i.
Mass. Hydrarg. grs. iii. M.
Ft. chts. No. i.
S. To be taken every morning and evening.

7.

℞ Pv. Digital. grs. x.
Scillæ, grs. xv.
Hyd. Chl. Mit. grs. v.
Ext. Gentian, q. s. ut.
Ft. Pil. No. x.
S. One, night and morning.

8. In hydrothorax.

℞ Infus. Digital. fʒiv.
Potas. Acet. ℈i.
Spts. Æth. Nit. fʒi.
Aqua Cinnam. fʒv. M.
Ft. haust.
S. Every sixth hour.

9.

℞ Acet. Colch. f℥ss.
Potas. Acet. ʒii.
Aqua Fœnic. f℥vii.
Spts. Junip. Comp. f℥ss
S. Two tablespoonfuls, three times a day.

10. In dropsy with great debility, and oppression of the chest.

℞ Decoct. Senegæ, f ℥v.
Tr. Scillæ, f ʒi.
Spts. Junip. Comp. f ʒiii.
Syr. simp. f ʒiv.
Spts. Æth. Nit. f ʒii. M.
S. Two tablespoonfuls every 4 hours.

11. In chronic inflammation of the kidneys and bladder.

℞ Uva Ursi, ʒiss.
Carb. Sodæ, Exsic. ʒss.
Pv. Cinnam. Comp. ʒss.
Confect. Rosæ, q. s.
Ft. Bolos. No. vi.
S. One, three times a day.

12.

℞ Decoct. Uva Ursi,
Liquor Calcis, āā f ℥iv. M.
S. Two fluidounces, four times a day.

13. In leucorrhœa and gleet.

℞ Pv. Secal. Cornut. ℈ii.
Cubeb. ℥i.
Cinnam. ʒss.
Sacch. Alb. ʒi. M.
Ft. chts. No. viii.
S. One, three or four times a day.

14. In dropsy complicated with disease of the liver.

℞ Ext. Tarax. ʒss.
Mass. Hydrarg. grs. v.–x.
Pv. Uva Ursi, q. s. ut.
Ft. Pil. No. x.
S. One, morning noon, and night.

15.

℞ Tr. Jalapæ, f ʒiii.
Acet. Scillæ, f ʒi.
Aqua Menth. Pip. f ℥. M.
Ft. haust.
S. Take three times a day.

16. Dr. Ferriar's diuretic drops.

℞ Oxym. Colch.
Scillæ,
Tr. Nicotianæ,
Spts. Æth. Nit. āā f ℥ss. M.
S. A teaspoonful in a little water, three times a day.

17.

℞ Infus. Digital. f ʒiv.
Tr. Digital. f ʒi.
Potas. Acet. f ʒi.
Tr. Opii, gtts. x. M.
S. A tablespoonful, three or four times a day.

18. In the passage of calculi down the ureters.

℞ Ol. Terebinth. gtts. c.
Pv. Gum Acac.
Sacch. Alb. āā ʒi.
Aqua Menth. Sativ. f ℥iv. M.
S. A tablespoonful, four or five times a day, followed by a diuretic drink.

19. Chapman's balsam copaiba mixture.

℞ Bals. Copaib.
Spts. Æth. Nit. āā f ℥ss.
Pv. Gum Acac.
Sacch. Alb. āā ʒi.
Tr. Lavand. Comp. f ʒii.
Opii, ʒi.
Aqua distil. f ℥iv. M.
S. A tablespoonful, three times a day.

20. In gonorrhœa.

℞ Bals. Copaib.
Pv. Cubebarum,
Muc. Gum Acac.
Tr. Opii Camph. āā f ℥ss.
Sacch. Alb. ʒii.
Aqua, distil. f ℥viii. M.
S. A tablespoonful, every three hours.

21. Dr. Ferriar's hydragogue.

℞ Gambogiæ, grs. iv.
Spts. Æth. Nit. f ʒi.
Tr. Sennæ, f ʒii.
Syr. Rhamni,
Aqua Menth. āā f ℥ss. M.
Ft. haust.

22. In dropsy following scarlatina.

℞ Tinct. Digitalis, gtts. xvi.
Potas. Acet. grs. lxxx.
Scillæ Syr. f ℥i.
Scillæ Acet. f ℥ss.
Aqua Menth. pip. f ℥ss.
S. A teaspoonful, to a child, every two hours.

23. Infusion of dandelion.

℞ Infus. Tarax. f ℥iv.
Ext. Tarax. f ʒii.
Sodæ Carb. ʒss.
Potas. Tart. ʒiii.
T. Rhei. f ʒiii.
Hyos. gtts. xx. M.
S. One-third part, three times a day.

DIAPHORETICS.

1. In febrile diseases.
℞ Pv. Potas. Nit. ℨi.
Ant. et Potas. Tart. gr. i.
Hyd. Chl. Mit. grs. vi. M
Ft. chts. No. vi.
S. One, every two hours.

2.
℞ Pv. Potas. Nit. ℨss.
Opii, grs. iii.
Ipecac. grs. vi.
Hyd. Chl. Mit. gr. iss. M.
Ft. chts. No. vi.
S. One, every four hours.

3. A stimulating draught.
℞ Pv. Guaiaci,
Potas. Nit. āā ℨi.
Ipecac. grs. iii.
Opii, grs. ii. M.
Ft. chts. No. vi.
S. One, every third hour.

4. In acute rheumatism.
℞ Ant. et Potas. Tart. gr. i.
Pv. Opii,
Hyd. Chl. Mit. āā gr. i.
Confect. Rosæ, q. s. M.
Ft. Pil.
S. To be taken each eighth hour.

5. Plummer's Pills, for secondary syphilis, gleet, &c.
℞ Hyd. Chl. Mit.
Ant. Sulphuret. āā ℨss.
Pv. Guaiaci, ℨi.
Bals. Copaib. q. s. M.
S. Ft. Pil. No. ix.

6
℞ Potas. Sulph.
Nit. āā partes iv.
Pv. Ipecac.
Opii,
Glycyrrh. āā part. i. M.
S. Ten grains at bed-time.

7. In inflammatory diseases.
℞ Potas. Nit. grs. v.
Liq. Ammon. Acet. fℨii.
Aqua Menth. fℨv.
Vin. Ant. et Potas. Tart. ♏xx.
Syr. Muc. Acac. fℨii. M.
S. A draught every four hours.

8.
℞ Spts. Æth. Nit. fℨviii.
Vin. Ipecac. fℨi.
Mist. Camph. ℥v
Syr. simp. fℨiv.
S. Two tablespoonfuls, every three or four hours.

9. In rheumatism.
℞ Pv. Doveri, grs. vi.
Liq. Ammon. Acet. fℨiii.
Pv. Acac. grs. x.
Aqua Cinnam. fℨix. M.
S. A draught every six hours.

10. In the same.
℞ Ant. et Potas. Tart. gr. ss.
Hyd. Chl. Mit. grs. iv.
Pv. Opii, grs. ii.
Conf. Rosæ, q. s. M.
Ft. Pil. No. ii.
S. One, at bed-time.

11. In chronic rheumatism.
℞ Tr. Guaiaci Ammon. fℨi.
Pv. Trag. grs. xv.
Aqua Cinnam. fℨiss. M.
S. A draught, three times a day.

12. In the same.
℞ Gum Guaiaci, grs. x.
Pv. Doveri, grs. v.
Potas. Nit. grs. x.
Conf. Rosæ, q. s. ut
Ft. Bolus.
S. Take at bed-time.

13. Powders of calomel and opium.
℞ Pv. Opii, grs. iv.
Hyd. Chl. Mit. grs. xvi
Pv. Ipecac. grs. viii. M.
Ft. Pil. No. viii.
S. One every hour or two.

14. Neutral mixture and tartar emetic.
℞ Sac. Limon. recent. ℥iss.
Potas. Carb. q. s. ad saturandum,
Tart. Ant. et Potas. gr. i.
Sacch. Alb. ℨi.–ℨii.
Aqua distil. f℥iii. M.
S. A tablespoonful every two hours.

15. In acute rheumatism.
℞ Pv. Antimonialis, grs. x.
Opii,
Hyd. Chl. Mit. āā grs. ii.
Confect. Rosæ, q. s.

Ft. Pil. No. iv.
S. Two, at bed-time.

16.

℞ Tr. Opii, gtts. xxv.
Spts. Æth. Nit. fʒi.
Vin. Ant. gtts. xx.
Aqua distil. f℥ss. M.
S. All at dose; and repeated, pro re nata.

17. Guaiacum mixture.

℞ Pv. Guaiaci. ʒii.
Potas. Nit. ʒiss.
Gum Acac. ʒi.
Glycyrrh. ℈i.
Tart. Ant. et Potas. gr. iss.
Aqua distil. f℥viii. M.
S. A tablespoonful three times a day.

18. Rob. anti-syphilitic of Laffecteur, said to be Swaim's Panacea.

℞ Rad. Smilacis. Sarsap.
Arud. Phragmitis, āā ℥xxx.
Florum. Borag. offic. ℥viii.
Foliorum Cassiæ Sennæ.
Petalarum Rosæ Albæ, āā ℥ii.
Sacch. Alb.
Mellis, āā ℔vi. M.
S. Boil the sarsaparilla and marsh seed grass in nine pints of water for an hour, strain off the decoction, and pour the same quantity on the residuum, which is to be boiled for two hours. Towards the end of the boiling add the borage flower, senna, and rose-leaves, and then strain off, and to both decoctions add the sugar and honey, and boil the whole to the consistence of a syrup.
For a man six tablespoonfuls, and for a woman four, taken without addition at six in the morning. Afterwards boil ℥ii. sarsaparilla in three quarts of water to two quarts, infuse during the night, and strain in the morning. Dose, a tumblerful frequently during the day.

EXPECTORANTS.

1.

℞ Pv. Scillæ. grs. viii.
Ipecac. grs. v.
Camph. ℈i.
Sacch. purif. ʒi. M.
Ft. chts. No. iv.
S. One, twice a day, followed by a decoction of barley.

2. In catarrh.

℞ Tr. Scillæ,
Vin. Ipecac. āā fʒi.
Mist. Amygd. Amar. f℥v.
Syr. Tolu. fʒvi. M.
S. A tablespoonful when the cough is severe.

3.

℞ Tr. Scillæ, gtts. x.
Acid. Nit. Dilut. gtts. vi.
Ext. Hyos. grs. iii.
Aqua distil. f℥iss. M.
S. Take every three hours.

4. In chronic coughs.

℞ Decoct. Polyg. Senegæ, f℥vi.
Gum Ammoniac. ʒss.–ʒi.
Syr. Tolu. f℥i. M.
S A tablespoonful every two hours.

5.

℞ Decoct. Polyg. Seneg. f℥iii.
Scillæ Oxym. ℥i. M.
S. A tablespoonful every two hours.

6. In chronic catarrh.

℞ Pv. Scillæ, grs. xxx.
Gum Ammoniaci, ʒiss.
Ext. Conii, grs. xxx. M.
Ft. Pil. No. xxx.
S. Take two every six hours.

7. In old asthmas.

℞ Mist. Ammoniaci, f℥iv.
Vin. Ipecac. f℥iv.
Tr. Camph. Comp. fʒss.
Syr. Tolu. f℥i. M.
S. A dessertspoonful when the cough is most urgent.

8. Expectorant pills.

℞ Pv. Scillæ, ʒss.
Myrrhæ, ʒiss.
Ext. Hyos. ʒii. M.
Ft. Pil. No. xxxvi.
S. Take two in a day.

9. Pectoral mixture of Boerhaave.

℞ Acet. Scillæ, f ʒvi.
Oxy. Scillæ, f ℥iii.
Sodæ Sulph. ʒi.
Decoct. Hordei, f ℥viii. M.
S. ℥i. to be taken each half hour.

10.

℞ Pv. Ext. Glycyr.
Gum Acac. āā ʒii.
Aqua Fervent. f ℥iv.
Spts. Nitr. Dulc. f ʒii.
Vin. Ant. f ℥ss.
Tr. Opii, f ʒss. M.
S. A tablespoonful three times a day.

11.

℞ Syr. Scillæ, f ℥ss.
Tr. Opii, Camph. f ʒii.
Vin. Ant. f ℥i. M.
S. A teaspoonful every three hours.

12.

℞ Potas. Carb. grs. xx.
Vin. Ipecac. f ℥ss.
Tr. Opii Camph. f ℥i.
Tr. Lavand. Comp. f ʒii. M.
S. A teaspoonful every four hours.

13.

℞ Acid. Hydrocyan. gtts. viii.
Gum Acac.
Sacch. Alb. āā ʒii.
Aqua Rosæ, f ℥viii. M.
S. A tablespoonful every four hours.

14. In pertussis.

℞ Zinci Sulph. grs. x.
Pv. Myrrhæ, ʒiss.
Confect. Rosarum, q. s. ut.
Ft. Pil. No. xx.
S. A pill every two hours.

15. Wistar's cough lozenges.

℞ Pv. Gum Acac.
Ext. Glycyrrh.
Sacch. Alb. āā ʒii.
Opii, grs. vi.
Ol. Anisi, gtts. iv. M.
Adde
Aqua, qs. ft. Lozenges lx.
S. Dissolve one of these in the mouth, three or four times a day.

16. Spitta's lozenges for coryza.

℞ Pv. Cubebarum, ʒii.
Bals. Tolu. grs. vi.
Syr. Bals. Peru,
Ext. Glycyrrh. āā ℥i.
Gum Acac. q. s.
Ft. Lozenges, āā grs. x.

17. For children.

℞ Syr. Scillæ, f ℥ss.
Tr. Opii Camph. f ʒii.
Vin. Ant. f ʒi.
Pv. Gum Acac. ʒss.
Aqua distil. f ℥ii. M.
S. A teaspoonful every hour or two.

18. In croup.

℞ Inf. Polig. Seneg. f ℥iv.
Syr. Ipecac. f ℥i.
Oxym. Scillæ, f ʒiii.
Tart. Ant. et Potas. gr. iss. M.
S. A teaspoonful, pro re nata, for children of two years of age.

19. In croup as an emetic expectorant.

℞ Alum et Potas. Sulph. pv. ʒi.
S. Add this to a teaspoonful of molasses, and repeat if necessary in ten or fifteen minutes until it vomits.

20. Mixture of bicarbonate of soda, in hooping-cough.

℞ Sodæ Bicarb. grs. xii.
Vin. Ipecac. gtts. xx.
Tr. Opii, gtts. iv.
Aqua distil. f ℥i. M.
S. A teaspoonful every two or three hours.

21. For the same.

℞ Potas. Carb. ℈i.
Pv. Coccus Cocti, ℈ss.
Sacch. Alb. ʒi.
Aqua distil. f ℥iv. M.
S. A teaspoonful every two or three hours for children.

22. For the same.

℞ Alum et Potas. Sulph. grs. xxiv.
Ext. Conii. grs. xii.
Syr Rhœados, f ʒxii.
Aqua Anethi. f ℥iii. M.
S. A teaspoonful every six hours for a child over two years.

23. For the same.

℞ Alum et Potas. Sulph. ℈iiss.
Syr. Zingib.
Acac.
Aqua font. āā f ℥i. M.
S. A teaspoonful every six hours for a child over two years.

24. For the same.
℞ Ex. Belladon, grs. iii.
Alum, et Potas. Sulph. ℈iiss.
Syr. Zingib.
Acac.
Aqua font. āā f℥i. M.
S. Dose, as the preceding.

25. For the same.
℞ Gum Assafœt. f℥i.
Aqua distil. f℥iv.
Ft. Solutio, et adde
Tr. Tolu. f℥ss.
Opii, gtts. xl.–l. M.
S. A teaspoonful every two hours for a child.

26. Mixture of cyanide of potassium.
℞ Potas. Hydrocyanici Medica, ʒi.
Aqua distil. Oi.
Sacch. purif. f℥iss. M.
S. A dessertspoonful night and morning.

27. Gum ammoniac mixture.
℞ Mist. Ammoniaci, f℥iii.
Tr. Castorei, fʒss.
Syr. Tolu. f℥ss.
Tr. Opii, gtts. v.
Aqua Cinnam. f℥i. M.
S. A dessertspoonful every three or four hours.

28. In bronchitis, attended with much fever.
℞ Pv. Ipecac. grs. xii.
Hyd. Chl. Mit. grs. iv.
Conf. Rosæ, q. s.
Ft. Pil. No. viii.
S. One, every fourth or sixth hour.

29. In pneumonia of young subjects.
℞ Liq. Antim. et Potas. Tart. fʒi.–ii.
Tr. Opii, ♏ii.
Muc. Acac. f℥ss.
Syr. Limon. fʒii.
Aqua Menth. f℥i. M.
S. From one to two teaspoonfuls every two hours.

30.
℞ Ext. Conii, ʒss.
Pv. Scillæ, grs. x.
Pv. Ipecac. grs. v. M.
Ft. Pil. No. x.
S. One, two or three times a day.

31. In asthma.
℞ Tr. Scillæ. ♏xv.
Acid. Nit. Dil. ♏xv.
Ext. Hyos. grs. iii.
Aqua, f℥iss. M.
S. A draught every three or four hours, until the fourth repetition.

32.
℞ Mist. Assafœt f℥iii.
Aqua Menth. Pip. f℥ii.
Tr. Scillæ, fʒii.
Camph. comp. fʒii.
Syr. Tolu. fʒiv. M.
S. A tablespoonful every four hours

33. In catarrh of the aged.
℞ Gum Assafœt. ℈i.
Pv. Ipecac. ʒss.
Scillæ, grs. viii.
Syr. Tolu.
Sap. Duri, āā q. s. ut
Ft. Pil. No. xvi.
S. One, every four hours.

EMMENAGOGUES.

1. Pills of myrrh, sulphate of iron, &c.
℞ Gum Myrrh,
Ferri Sulph. āā ℈ii.
Potas. Carb.
Sapo purif, āā ʒss. M.
Ft. Pil. No. xl.
S One, morning, noon, and night.

2. Decoction of madder.
℞ Pv. Rub. Tinct. ℥i.
Aqua bullient. Oi.
Simmer for 15 minutes and add
Caryoph. contus. ʒi. M.
S. When cool, strain, and give a wineglassful every three hours, a short time before the expected return of the menses.

3. In menhorrhagia.
℞ Ol. Erigerum. Philadel. gtts. clx.
Gum Acac.
Sacch. Alb. āā ʒss.
Aqua Menth. pip. q. s. ft. f℥ii. M
S. A teaspoonful every two hours.

4.

℞ Tr. Helleb. Nig. f℥ss.
Myrrhæ, f℥i.
Canthar. fʒii. M.
S. Thirty drops, three times a day in a little sugar and water.

5. Dewee's tr. guaiaci.

℞ Pv. Guaiaci, ℥iv.
Potas. vel. Sodæ Carb. ʒiss.
Pv. Pimenta, ℥i.
Alcohol diluti, ℔i. M.
S. Digest for a few days, and add the Aqua Ammoniæ, in the proportion of ʒi.–ʒii. to every four ounces of the tincture. A teaspoonful in a little sweetened milk, or Sherry or Teneriffe wine.

6.

℞ Vin. Ferri, f℥i.
Tr. Aloe Comp. fʒvi.
Castor, fʒii. M.
S. A teaspoonful, 3 times a day, in a cupful of infusion of chamomile.

7.

℞ Pil. Aloe cum Myrrh,
Ferri Comp. āā ʒi. M.
Ft. Pil. No. xxiv.
S. Two or three, twice a day.

8.

℞ Ferri Sulph. ʒi.
Potas. Carb. grs. vi.
Myrrhæ, ʒi.
Pv. Aloe Comp. ʒss. M.
Ft. Pil. No. xxx.
S. Take three, twice a day.

ALTERATIVES, &C.

1. In acute inflammations.

℞ Hyd. Chl. Mit. ʒss.
Pv. Opii, grs. v.
Antim. ℈i.
Conf. Rosæ, q. s. ut
Ft. Pil. No. xv.
S. One, every fourth hour.

2.

℞ Hyd. Chl. Mit. gr. i.
Ext. Gentian. q. s.
Ft. Pil. No. xii.
S. One, every hour.

3. For infants.

℞ Hyd. cum Creta, ʒss.
Pv. Ipecac. grs. x.
Rhei, ℈ii.
Cinnam. Comp. grs. x.
Sacch. Alb. ʒi. M.
Ft. chts. No. x.
S. One, two or three times a day.

4. In syphilitic affections, lepra, &c.

℞ Hyd. Corros. Chlor. grs. ii.
Spts. Vin. Rect. fʒiv.
Aqua distil. f℥iiiss. M.
S. A teaspoonful, in a cupful of the decoction of barley, daily.

5. In scrofula.

℞ Hyd. Corros. Chlor. gr. i.
Tr. Cinch. f℥ii. M.
S. A teaspoonful, twice a day in a cupful of the infusion of chamomile.

6. Black wash.

℞ Hyd. Chl. Mit. ʒii.
Liquor Calcis, ℔i. M.
S. Applicable to syphilitic ulcerations.

7. In the same cases.

℞ Hyd. Corros. Chlor. grs. xxiv.
Liquor Calcis, ℔i. M.

8. In chronic inflammation of the tarsi and conjunctiva.

℞ Hyd. Ox. Rub. ʒss.
Adeps prep. ℥i.
Ceræ Albæ, ℈iv. M.

9. In the same.

℞ Hyd. Ox. Rub. grs. v.
Zinci Sulph. grs. x.
Adeps, ℥i. M.

10.

℞ Ol. Gadus. Morrhuæ. f℥ss.
S. Take this quantity in a little porter, ale, or juice of orange, or bitter tincture, three times a day.

11. In pneumonia and acute rheumatism.

℞ Tart. Ant. et Potas. grs. vi.
Aqua Cinnam.
Aqua distil. āā f℥viii.
Syr. Althææ, f℥ii. M.
S. A sixth part every two hours. After the sixth dose omit the medicine, except in severe cases, for seven

or eight hours. If it sickens, add ʒiii.–iv. of Tr. Camph. comp.

12. In chronic cutaneous diseases.

℞ Sulph. Ant. Aurat. grs. x.
Flor. Sulph. ʒiss.
Guaiaci Resin.
Ext. Conii, āā ʒi.
Sacch. Alb. q. s.
Ft. Pil. No. lx.
S. Three, three times a day.

13. In syphilitic affections, chronic rheumatism, &c.

℞ Potas. Iod. grs. iii.–v.
Aqua distil. f℥i. M.
S. A draught, three times a day.

14.

℞ Hydrarg. Proto. Iod. grs. xii.
Ft. Pil. No. xii.
S. Take one at night going to bed; follow it by a tablespoonful of cod liver oil, three times a day.

15. In hypertrophy of the heart.

℞ Potas. Iod. ʒi.
Tr. Digital. ♏xl.
Lactucarii, ℈i.
Aqua distil. f℥iii.
Flor. Aurant. fʒii.
Syr. Althææ, fʒvi. M.
S. A tablespoonful night and morning.

16. In scrofula, chlorosis, amenorrhœa.

℞ Ferri Iod. grs. ii.
Aqua distil. f℥i. M.
S. Take three times a day, in a cupful of sweetened water.

17. In syphilis.

℞ Hyd. Biniod. gr. i.
Ext. Glycyrr. grs. xxxii. M.
Ft. Pil. No. xvi.
S. One, night and morning; use with care.

18.

℞ Potas. Bromidi, grs. xii.
Aqua distil. f℥iii.
Syr. Althææ, f℥i. M.
S. A tablespoonful three times a day

19.

℞ Hyd. Chl. Mit. grs. vi.
Pv. Opii, grs. iii.
Quiniæ Sulph. grs. xii.
Syr. simp. q. s. ut
Ft. Pil. No. xii.
S. One, night and morning.

20.

℞ Hyd. Chl. Mit. grs. xii.
Confect. Rosarum, q. s. ut
Ft. Pil. No. xii.
S. One, morning and evening.

21. Pills of corrosive sublimate.

℞ Hyd. Chl. Coros.
Hydrochlor, Ammoniæ, āā grs. v.
Aqua distil. gtts. xxx.–xl.
Confect. Rosarum, ℈i.
Pv. Glycyrrh. q. s. ut
Ft. Pil. No. xl.
S. One, three or four times a day.

22. Hunter's pills of the red oxide of mercury in venereal.

℞ Hyd. Ox. Rub. grs. iii.
Pv. Opii, gr. i.
Ol. Caryoph. gtts. ii. M.
Ft. Pil. No. iii.
S. One, every night for a week.

23. In herpes attended with inflammation and itching.

℞ Hyd. Cyanureti, grs. xvi.
Adeps Prep. ℥i.
Essent. Citric Medicæ, gtts. xv. M.

24. In tuberculous lepra.

℞ Arsen. Protox. grs. iv.
Piper. Nig. ʒix. M.
S. Pound these substances in a mortar for a few days, at intervals, with water enough to form a mass. Ft. Pil. c. Take one or two daily.

ANTACIDS.

1.

℞ Magnes. ℥ss.
Sodæ Bicarb.
Pv. Zingib. āā ℈i. M.
S. A small teaspoonful in cardialgia.

2. In acid stomach.

℞ Potas. Bicarb. ʒi.
Sacch. Alb. ʒi.
Tr. Lavand. Comp. fʒii.
Opii, fʒss.

Aqua Menth. Pip. f℥iv. M.
S. Tablespoonful every two hours.

3. In pyrosis.
℞ Potas. Bicarb. ʒiii.
Aqua Cinnam. f℥iv.
Spts. Ammoniæ, fʒi. M.
S. A teaspoonful, pro re nata.

4. In acidity and flatulency.
℞ Sodæ Bicarb. ℈iv.
Infus. Gent. Comp.
Aqua Cinnam. āā fʒiii.
Tr. Card. f℥ss. M.
S. A tablespoonful every three hours.

5. To relieve sickness and acidity of stomach.
℞ Magnes. ʒii.
Gum Camph. grs. x.
Æth. Sulph. fʒii.
Aqua, ℥vi. M.
S A tablespoonful every two hours till relieved.

6.
℞ Magnes. ʒii.
Spts. Ammon. Arom. fʒii.
Aqua, f℥vi. M.
S. A tablespoonful every half hour till relieved.

7. In diarrhœa.
℞ Calc. Carb. Prep. ʒiss.
Pv. Cinnam. ʒi.
Piper. grs. viii.
Opii, grs. vi. M.
Ft. chts. No. xii.
S. One, three times a day.

8. In dyspepsia.
℞ Pv. Rhei,
Sodæ Carb. Exsic.
Ext. Gent. āā ℈i.
Hyd. Chl. Mit. grs. iii. M.
Ft. Pil. No. xx.
S. Two occasionally.

9. Chalk mixture.
℞ Cretæ Prep. ʒiss.–ʒii.
Sacch. Alb.
Pv. Gum Acac. āā q. s.
Aqua Menth. f℥vi. M.
S. A tablespoonful every two hours.

10. Griffith's magnesia and camphor mixture, for flatulency and irritable stomach.
℞ Magnes. ʒi.
Camphoræ, ʒss.
Sacch. Alb.
Gum Acac. āā ʒii.
Æth. Sulphurici, fʒss.
Aqua distil. f℥iv. M.
S. A tablespoonful four times a day.

11. Physick's dyspepsic ley.
℞ Hickory ashes,
Soot, āā Oi.
Aqua bullient. Cong. i. M.
S. Let stand twenty-four hours, and strain clear. A wineglassful an hour after each meal.

12.
℞ Liquor Potassæ, ♏xx.
Mist. Cretæ, f℥ii.
Tr. Colomb. fʒi. M.
S. Take three times a day.

13. In cardialgia.
℞ Magnes. ʒi.
Aqua Menth. Pip. f℥xv.
Tr. Aurant. fʒi. M.
S. A draught, pro re nata.

14. In pyrosis.
℞ Magnes. ʒii.
Pv. Rhei, ℈ii.
Aqua Cinnam.
Font. āā f℥iiiss.
Syr. Ammon. Aromat.
Zingib. āā ʒiv. M.
S. Two tablespoonfuls 3 times a day

ANTHELMINTICS.

1.
℞ Stani. Pv. ℥i.
Ext. Artem. Absinth.
Pv. Jalap, āā ʒii.
Syr. Aurant. q. s.
Ft. Bolos. No. xii.
S. One, every half hour till an evacuation occurs.

2.
℞ Dolichos. Mucun. ʒi.
Theriacæ, ℥i. M.
Ft. Elect.
S. A teaspoonful every morning.

3.
℞ Hyd. Chl. Mit. fʒss.

Pv. Gamboge, ʒss.
Zingib. ʒss. M
Ft. chts. No. iv.
S. One every morning.

4.
℞ Pv. Spigel.
Sennæ, āā ℈ii. M.
Sabinæ, grs. xii. M.
Ft. chts. No. iv.
S. One every morning.

5.
℞ Pv. Stani. ℥ss.
Dolic. Mucun. ʒi. M.
Ft. chts. No. ii.
S. One in the morning.

6. For tape worm.
℞ Pv. Granati Cort. ℥ss.
Ft. chts. No. vi.
S. Take one every half hour, till the sixth is taken, and follow the last dose with senna and salts. The whole treatment may be repeated, at the interval of a week, to the third time.

7. In tape worm.
℞ Ol. Pep. Sem. f℥ii.
(or pumpkin seed.)
S. Take this as a dose upon an empty stomach. It may be administered by the seeds being deprived of their outer coating and rubbed up with sugar, and adding water gradually, and followed by a dose of castor oil.

8. Infusion of Kousso.
℞ Flor. Bray. Anthelmint. ℥ss.
Aqua bullient. f℥x. M.
S. Macerate for half an hour. Take the tea and flowers as a dose. First evacuate the bowels by a mild purgative; then take a little lemon juice and follow with the dose; afterwards take a little water and lemon juice. It should operate in three or four hours, or be followed by oil.

9.
℞ Ol. Terebinth, ℥i.
Ricini, ℥i.
Tr. Rhei, fʒi. M.
S. One-fourth in the morning.

10.
℞ Hyd. Chl. Mit. grs. ii.
Sem. Artem. Santon. grs. viii.
Camphoræ, grs. vi.
Syrup, q. s. ut
Ft. Bolus.
S. To be repeated, pro re nata, for children four or six years of age.

11. Worm tea.
℞ Rad. Spigel. ℥ss.
Sennæ, ʒii.
Manna, ℥i.
Sem. Fœnic. ʒii.–℥ss.
Aqua bullient. Oi. M.
S. A wineglassful to a child of two years old, three or four times a day.

12. Mixture of worm seed oil.
℞ Ol. Chenopodii, ʒi.
Sacch. Alb.
Gum Acac. āā ʒss. M.
Add,
Aqua Menth. Sativ. f℥iiss. M.
S. A teaspoonful to be given four times a day, for two days in succession, and then purged off with castor oil or salts. For children from three to eight years old.

13. Enema in ascarides.
℞ Pv. Aloe, ʒii.
Lac. recent, Oi. M.
S. The half to be given to a child eight or ten years old.

P. S. — In a few instances prescriptions have been repeated on account of their applicability to different classes of remedies.

THE END.

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